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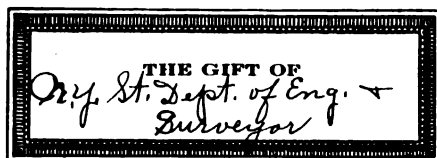
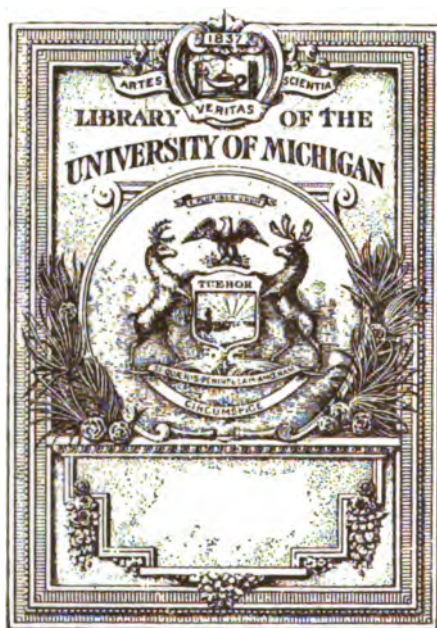
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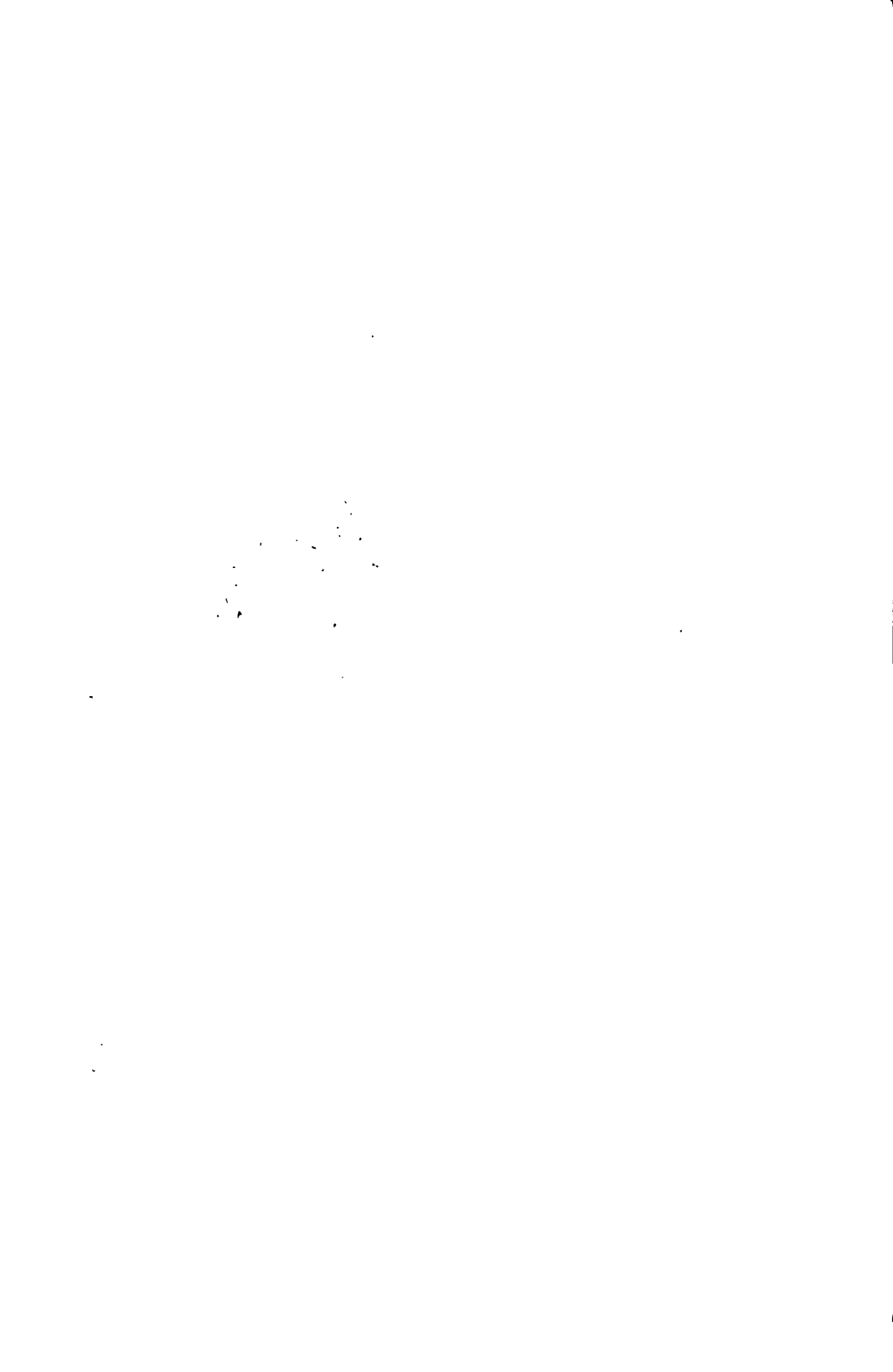
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FROM LAKES TO OCEAN — OPENING THE FIRST SECTION

Boats entering the first lock at the official opening of the eastern section of the Erie canal, May 15, 1915. Aboard the first boat were Governor Whitman, State Engineer Williams, Superintendent of Public Works Wotherspoon, Secretary of State Hugo, Attorney-General Woodbury, Treasurer Wells and others, while the second boat carried press representatives.

HISTORY OF THE BARGE CANAL OF NEW YORK STATE

BY

NOBLE E. WHITFORD

Senior Assistant Engineer, State Engineer's Department; Assoc. Member Am. Soc. C. E.

UNDER AUTHORITY OF
FRANK M. WILLIAMS
State Engineer and Surveyor

Supplement to the Annual Report of the State Engineer and Surveyor for the
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INTRODUCTION

TRANSPORTATION is a matter of supreme importance to every nation, and the question of improving transportation is of more fundamental concern to most nations than any other problem which confronts them. "The most profound economic changes of modern times," said the Deep Waterways Commissioners, "have been brought about by the improvements in transportation. These began with small canals and later with railroad construction, in the first half of the century, and have proceeded with accelerating speed to the present time."

The importance of transportation to the welfare of a nation was most strikingly illustrated by the attitude of the Chinese delegates at the recent Limitation of Armaments Conference. To this body were presented for consideration some of the weightiest problems in the world's economy, among them the whole Oriental policy, but early in the deliberations these delegates said that so far as China was concerned the Conference would result in utter and irredeemable failure if control of the Kiaochow-Tsinanfu railway in Shantung were not again restored to her.

What student of history can doubt that the possession of natural transportation routes has been a controlling factor, often the predominant factor, in the destiny of nations? Transportation has been important all through the history of the world, but never so important as now. In the earlier days countries and even small localities were often self-sufficient, but at present all parts of the world are dependent for many of their necessities as well as their luxuries on nearly every other part. Competition too has become very keen in the race for supplying the world's needs and the nation which has the best means for transporting its products has an enviable advantage over its less-favored rivals.

Coming nearer home we are moved to ask, Why did New York become in fact as well as in name the Empire State? We may answer this by asking another question. Why did the earlier possessors of the same region, the Six Nations, occupy their position of preëminence among the aboriginal tribes? We answer that the situation of their lands, at the headwaters of the streams which flowed into all the neighboring territory, giving them easy access to these regions both in peace and war, had quite as much to do with their fortunate estate as their valor. In like manner New

York's natural endowment of transportation routes, strengthened by wise development, has been her making. New York is the only state fronting on both Great Lakes and ocean. New York has the best harbor on the Atlantic coast. The great river flowing into this harbor is the only stream in the country that has cut a navigable channel through the Atlantic coast range of mountains. New York has the only feasible route in the United States for a waterway between the great inland seas and the ocean and by the same token it has the route of easiest grades for railroads or other wheeled media of transportation. Other favorable routes in New York, one straight through to the northern boundary and several scattered about the central region, have conduced to vigorous local development. If anyone doubts that these potential transportation routes gave New York its start toward preëminence, let him read history and learn that before she began to avail herself of these natural advantages she did not stand at the top commercially. But New York's greatness is not just at present our special theme. Mention of it is merely incidental to showing that transportation is paramount. It was a matter of accident that she possessed these natural advantages.

In serving herself New York served her country even more. Much of the development of the vast central region and also of the eastern section of our land is due to these routes of travel and transport, by water and by rail, which happen to lie in New York state.

A generation ago there was an idea prevalent in the land that canals were a worn-out institution. If one still holds to this notion, he need only review the trend of enlightened public sentiment for the past quarter century; he has but to read the account of the recent National Rivers and Harbors Congress, in which the most prominent men of the whole country took active part and at which the delegates squarely and boldly demanded that Congress at once appropriate not less than the amount recommended as necessary by the chief of engineers; he should but be reminded that Europe awoke to the need of a waterway revival earlier than America and that within recent years every great European country in which topographic conditions permit has developed its canal system to a greater extent than its railroad system.

Since, therefore, the subject of transportation is so vitally important to our common welfare, since canals are again coming into their own and also since America's natural and logical canal

route to the interior is that which traverses New York state, the building by the State of a great modern canal along this route is a matter which concerns not New York alone but the whole nation. A history of the project accordingly, if it does justice to its theme, should be a valuable contribution to the literature of great achievements and moreover should contain something of interest to a wide circle of readers. Such a contribution the present volume attempts to be, and even if it falls short of its high privilege it cannot fail to become, because of the importance of the subject, of some appreciable value.

The entrance of the Barge canal idea into New York's waterway plans marked a new and radically changed era in the history of the State canals. Viewed from one angle the Barge canal, to be sure, is simply the enlargement of four existing canals, and to get the true historical setting and to understand why things happened as they did we must consider the undertaking from this point of view, but the new canal is much more than a mere enlargement; it is a change so fundamental in many particulars that the likeness between the old and the new is completely lost. Perhaps we can best explain this difference by first quoting from the report of the Committee on Canals, the body that gave concrete form to the Barge canal idea, and then adding a few words in elaboration.

"In our judgment," says the committee, "the efficiency of the canals depends quite as much upon the way the business is handled on them as upon their physical size, and we advise against the expenditure of any more money for their enlargement unless it shall be accompanied with measures which will lead to the adoption of more modern methods in conducting the business of water transportation across the state."

The appointment of this Committee on Canals by Governor Roosevelt, it will be observed as we proceed with the account, marked the clear line of cleavage between the old and the new in New York State canal history, and the following of its recommendations wrought the beginning of the change. The Barge canal is as much a modernization as an enlargement of the old waterway and perhaps the former characteristic is the more important, for probably upon its present-day methods and contrivances must depend the major part of whatever success crowns the venture. Not that there had been no worth-while improvements on the old canal. Several new ideas had been worked out with more or less success, but in the main the waterway as it then existed was a thing of the past, the

best of its day when it was inaugurated, it is true, but now worn out and being continued into a new age, vainly trying to compete with the marvelous improvements of that age. Against such odds any improvement which was not revolutionary could make little headway. Misinterpreting the situation, many persons said that the canal principle itself was out of date. They were mistaken; it was this particular canal which needed rejuvenating. The boats were old-fashioned; the animal-power method of propulsion was even more antiquated; the locks were still worked by main strength by the lock-tenders; the whole form of canal operation and management was equally old-fashioned. And worse still, the people of the state according to their several opinions on canal matters were either indifferent, complacent or tolerant of what they wanted to do away with entirely but had not the power, and a few were chafing under their inability to improve conditions. It needed a violent jolt to shake the State out of its lethargy and such a shock the failure of the nine-million-dollar project proved to be. Immediately following that undertaking (unfortunate it seemed at the time, but in the light of more mature judgment perhaps a most fortunate occurrence and the only thing that would have accomplished the necessary awakening) there came the careful study and the expert opinions of the Committee on Canals, men who were capable of giving unbiased and dependable advice. At last the State realized that it must make a radical change in its canal policy. It became willing finally to scrap its old canal and build in its stead a modern waterway.

Of the importance and magnitude of the Barge canal there can be no doubt. It is only natural of course that most New Yorkers should recognize this, but lest our opinions may become prejudiced it is well to view the enterprise through the eyes of an outsider but withal one who by training and experience is qualified to speak with authority. Let us listen then to the words of a Federal engineer who was sent by the Government to inspect the Barge canal in order that he might the better undertake certain national work.

"The first impression that comes to one on visiting the Barge canal," said this engineer, "is a feeling of respect for the energy and progressiveness of the people of the state who, having seen the necessity of an enormous engineering work to hold for the State and its metropolis their supremacy in the shipping of the country, do not hesitate to enter and push to rapid completion a work which any nation would hesitate to undertake." *

* Excerpt from a letter by Major C. O. Sherrill.

As one reads the following pages he will observe that the complete Barge canal plan did not spring into being Athena-like, full panoplied, but rather was a development, an evolution, a work which rounded out in completeness as its construction was being carried on to completion. Perhaps, however, it should not be said that completeness has already been attained. State Engineer Williams said recently that he did not expect the canal ever to be entirely completed, and the people of the state may well echo this statement in the spirit in which it was spoken and let it become for them a desire and an aim — that the time may never come when the growing commerce of the canal will not need new facilities.

The reader may perceive also how opportune has been the building of the Barge canal. It seems that it could not have been more timely if its sponsors had known the future in advance and had laid their plans accordingly. It was ready to serve the emergency of war, and that such service was curtailed was not the fault of the canal. But now it is ready for another service, a service as essential perhaps as that of war — the struggle for commercial supremacy that is following in the wake of the war. And America needs all the help it can get in this struggle. In none of the European countries are the distances from the interior to the sea very great. The American handicap of long hauls must be made as small as possible.

It cannot be denied nor even overlooked that there is abroad in our own state as well as in other quarters a prejudice against the New York canals. This feeling may be due in part to certain unsavory charges against the canals of a by-gone day. Perhaps some of it is due, especially in normally anti-canal regions, to the inveighing against the canals by politicians who have accepted this easy road to popularity by using the tools of the demagogue and appealing to an already existing antipathy, but who thereby have strengthened this feeling to the injury of the canals. Much of the prejudice is due doubtless to lack of information, especially a lack of accurate knowledge concerning the possibilities of the improved waterway and what it may accomplish for the State as a whole and for its individual users, if it is given a fair chance. Probably, however, the major portion of this opposition is the result of direct attempts to create a sentiment against the canals on the part of those whose interest it is that the canals should be discredited even to their complete undoing. And chief among those who are thus attempting to undermine the waterways are the railroads. It would

seem that the citizens of the state long ago should have perceived that this very opposition of the railroads proves the worth of the canals, and also that they should have ceased to be misled by the attacks.

At the latest National Rivers and Harbors Congress Major-General Lansing H. Beach, Chief of Engineers, gave vivid expression to this thought. As reported in the daily press he said, "You cannot get a better argument for the waterways than the attitude of the railroads toward them. They won't prorate; they won't issue bills of lading. It seems to be one of the principles of modern business to put a competitor out of the running before the consumer comes into consideration. And much that has been done by the railroads toward the waterways is simply the question of eliminating a competitor in business."

It is hoped that the present volume by setting forth what are believed to be accurate accounts and pertinent facts may in some degree help to remove this unfavorable judgment upon the canals and be the means of establishing a more open-minded attitude.

The testimony of European experience is that modern canals are a most valuable asset to a nation and moreover that even the railroads are benefited where the two systems are operated as complementary adjuncts rather than as antagonistic competitors.

In any public movement there is always a lively interest in the human agencies that brought it into being and that fostered its growth. So it is with the Barge canal. We want to know who conceived the idea, to whom we are indebted for the creation of a public sentiment in its favor, who guided its course through the maze of political strife and organized opposition, who were entrusted with its execution, in a word, the *dramatis personae* of the whole canal project. In these pages the names of the chief actors will usually appear and generally to them belongs much of the credit for what has been accomplished, but we must not forget that there have been many others who have played minor parts but whose names even must be sought among inconspicuous records. But there is one class of persons to whom honor is due whom we desire to mention in particular. These are the people who have been in the fight for canal improvements without any seeming personal interests at stake, men actuated apparently by little besides a constraining desire for the public good. Generally these persons have worked through the various waterway organizations that have been in existence more or less continually for the last thirty-five or forty years. They have been men of vision and to their voluntary,

unremunerated labor the State is beholden for much of whatever success may attend its waterway system. In times of crisis, when a public awakening has been needed, they have been the faithful few who could be depended on to rally to the support of their espoused cause.

It may seem at first thought somewhat early to write the history of the Barge canal. It is true, of course, that a contemporary writer lacks the perspective of years, but if, as in the present instance, he has the advantage of having taken part in the events he describes and of having had personal acquaintance with the men who were chiefly responsible for the happening of those events, such a contemporary writer may bring to his task much that a later author would lack. While he may miss the broad interpretation of the whole subject as viewed in the light of later history, he can better interpret the smaller parts. Knowing the circumstances, he may be able even to give true interpretation to certain records which another might entirely fail to understand. Also from his own personal knowledge he may often supply missing details.

A few words concerning the framework of the volume seem pertinent. The attempt has been made to present a broad outlook of waterway affairs, national as well as state, since most of these affairs had an influence in shaping Barge canal policies and in directing the course of events. In like manner the relationships existing between the New York canals and other water transportation routes in the country have received attention. The first six chapters deal with events occurring prior to the actual work of constructing the canal. The arrangement in these chapters is mainly chronological and even the division into chapters is chiefly for convenience of reference. In the remainder of the volume the arrangement is largely topical, the multiplicity of subjects involved in a complete treatment of the theme seeming to demand such procedure. Of course occasional overlappings have resulted and sometimes rather arbitrary divisions have been made. In explanation of the omission of quotation marks in making certain verbatim quotations from the annual reports of the State Engineer, the *History of the New York Canals*, published as a supplement to the 1905 State Engineer's report, the *Barge Canal Bulletin* and other publications of the State Engineer's department, it may be said that such action seems not improper, especially since often the author is quoting his own earlier words. In a sense this volume is a work of reference, but it does not profess to be a complete reference book.

The aim has been to study causes, discern the results, review policies and methods, and record important facts, but not to go exhaustively into the minutiae of detail. Such detail may be found, however, by him who must have it, and the sources of this information are described in the chapter on canal and terminal construction. Not much has been said concerning the financial and legal aspects, the processes of land acquisition and various other phases of the project. The manner in which the work has been financed is important, and many features connected with the vast amount of litigation and legal procedure are interesting as well as important, but more time than is now available would be required to do these subjects justice and even then they would have less popular interest than the topics which have been included.

CHAPTER I

THE EARLIER CANALS AND THE CAUSES WHICH BROUGHT ABOUT THE BARGE CANAL

The Barge Canal: Its Place and Importance in State Canal History—New York Canals, 1790 to 1862—Abandonment of Lateral Canals—Abolition of Tolls—Lock-Lengthening—Review of New York City Trade History and its Effect on Canal Improvements—"Seymour Plan" of Improvement—Windom Committee Report—Views on Toll Abolition—Canal Improvement Union—Discussion, American Society of Civil Engineers—State Engineer Schenck's Proposal—Constitutional Convention of 1894—Nine-Foot Deepening.

WHEN the people of New York state went to the polls in November, 1903, they were called upon to decide one of the weightiest questions ever brought before them for determination. This was nothing less than the question as to whether the State should undertake an improvement of its canal system which was so large in comparison with anything previously attempted, so far-reaching in its results and so different in its nature from the earlier canals that it was in effect a new canal policy.

It is realized of course that to the casual observer this may not appear so momentous an event. But the student of canal history can interpret the occasion with clearer understanding. He knows what material benefits the original Erie canal brought in its train. He is aware that this early waterway was the greatest single agency in placing New York in its proud position of eminence among the states of the Union, [that it was the chief instrumentality in opening and peopling the states of the Middle West, that the initial momentum it imparted to development and progress has been a force acting as a continuous acceleration from the day of the completed canal to this.] He has learned too that it brought other than material advantages, that probably its most signal benefit was one which the statesmen of that time recognized as the great need of the hour—its service in binding together by a more extensive and sympathetic intercourse and interdependence the great divisions of our land, in demolishing sectional jealousies and upbuilding mutual reliance, in dissolving provincialism and substituting a broad-minded community of interest and fraternity of spirit. He can understand why Lafayette pronounced the Erie canal "an admirable work of

science and patriotism." Also the student of modern waterways can discern with keener insight what may be the portent of the decision given that day in 1903 to enlarge the State canals. He in turn knows how great a factor recent waterway improvements have been in the rapid commercial development of other countries. He has discovered that "the most profound economic changes of modern times have been brought about by the improvements in transportation."

The people of the state gave an answer of approval at the election in 1903 and as a result the State has made the improvement then ordered; to use the popular phrase, it has constructed the "Barge canal."

We must know first what the Barge canal is. The name itself, acquired through popular usage and now so long the generally accepted designation that it has become permanently fixed, really has no distinctive meaning; that is, it has no distinctive meaning according to the exact definition of words. In its original, unabridged form, however, "Thousand-ton barge canal," it did specifically describe the thing which it named, but even this more definite term long ago became a misnomer, since subsequent legislative enactment largely increased the capacity of the canal. But according to the authorizing law this enterprise is simply the "Improvement of the Erie, the Oswego, the Champlain and the Cayuga and Seneca canals," and if we are to get the true historical setting of the project and learn what causes brought it into being and what mission it was designed to fulfill, we must recognize a fact which this official phrasing indicates, namely, that the undertaking is but one phase of a development which has been going on for more than a century. Moreover, in our whole study of the State canals we must remember that the waterways are the product of an evolution, and this rule holds in the case of the latest phase of this large evolution, the Barge canal, which has been a development even within itself and has come to include several features not embodied in the original project. To put ourselves in the way of understanding this development we must bring in review certain events of the past century and a half.

Glancing quickly over the history of water transportation in New York state, we see that up to 1790 only the natural streams, with but few artificial improvements, were in use, and that the little effort to better them was as yet without tangible results. Between 1791 and 1807 came the period of the Inland Lock Navigation Companies'

canals, during which the natural streams were improved by private enterprise and were used to a limited extent. The year 1808 marked the beginning of the agitation which resulted in the State commencing to build its own canal system in 1817. By 1825 the first two branches, the Erie and Champlain canals, had been completed. Then began a period of such unexpected success in the canal venture that five lateral canals were built by the State and two by private companies and the first enlargement of the Erie canal was begun, all within a decade. The years 1835 and 1862 are respectively the beginning and the official ending of the first canal enlargement. As a matter of fact, however, considerable remained to be done at the so-called completion in 1862 and gradually in after years this work was done. This period between 1835 and 1862 witnessed the enlargement of the Oswego, the Champlain and the Cayuga and Seneca canals as well as that of the Erie branch.

Our review of canal history after 1862 must proceed more slowly, since we soon come to events which bear directly upon the Barge canal project.

After so protracted a season of new construction as was the first enlargement, extending over a period of twenty-seven years, there naturally followed several years of little activity. It is significant, however, that scarcely four years had elapsed before the subject of additional enlargements had twice been seriously discussed.

From the beginning of waterway-building by the State the canals have had both their advocates and their opponents. The remarkable success attending the early years of the original canals gave rise to a blind, popular frenzy, which clamored for extensions and branches all over the state. Almost as unreasoning was an extreme disaffection toward the canals which was manifest in the late sixties and early seventies. This unfavorable attitude was growing for several years before it reached the climax of decisive action. The railroads had more and more been drawing traffic away from the canals. The revenue had been falling off and some of the lateral branches, which never had been self-sustaining, were making heavy demands on the surplus earnings of the more prosperous trunk lines. The canals, instead of being a rich source of income as in the initial years, had begun to draw on the public purse and the people grew restive. When, in addition there came purported revelations of extravagance, mismanagement and fraud, the outburst of popular disfavor could be appeased only by the abandonment of all but the five canals which remain today and a few short adjuncts of

these main branches. Four of these canals are included in the Barge canal system and the fifth delivers much of the required water-supply.

The most notable event in the years just succeeding the abandonment of the lateral canals is the abolition of tolls. Boatmen had long complained that they could not compete with rival routes and in an attempt to stem the tide of traffic diversion the tolls had been reduced year by year or had been entirely removed from certain articles. Since the Constitution restricted expenditures on canals to the revenues received, the continually decreasing tolls had not permitted the waterways to be kept in perfect repair and this condition in turn had reacted to the detriment of commerce.

At the general election in 1882 the people approved a constitutional amendment which made the State canals absolutely free. In one of its aspects this abolition of the tolls vitally concerns our study of later canal improvements. Thereafter the maintenance of the State waterways was paid from moneys appropriated by the Legislature and raised by taxation. The outcome has been that more extensive improvements were soon undertaken than was possible under the old policy and gradually the way was opened for accomplishing vast enterprises in comparatively short durations of time. In comparison it should be recalled that under the restrictive method of procedure the first canal enlargement was protracted through a period of twenty-seven years.

The year 1884 marks what may be termed the beginning of the present era of canal improvement. Since that year each succeeding project has followed so closely upon its predecessor that the time may with propriety be called a period of steady progress, which has gone on until the goal of a completed modern waterway, the Barge canal, has been reached.

The first improvement of this series was that of lock-lengthening. The Legislature of 1884 appropriated \$30,000 to lengthen lock No. 50, which is located just west of Syracuse. The bill was piloted through the Legislature by Hon. George Clinton, of Buffalo, grandson of DeWitt Clinton, chief promoter and builder of the original State canals, and himself for many years and to the present time a most ardent and persistent advocate of all measures for canal betterment.

During the first enlargement of the canal two locks had been built side by side. In the terminology of the time these were known as double locks, whereas locks placed end to end and each having a lift

were called combined locks. (The names twin locks for the former type and tandem locks for the latter are now often used.) Each of the double locks was 110 feet long between gates and 18 feet wide. In the scheme of lock-lengthening, which in the next few years succeeded the initial experiment at lock No. 50, one of these double locks was increased to a length of 220 feet between gates. Generally the lengthening was done at the foot of the old lock and the berme lock was more often selected as the one to be lengthened.

The purpose of this work was to make it possible to pass at one lockage two boats lashed together end to end. The practice of boats traveling thus in pairs had become quite common. Double headers they were called; sometimes they were horse-drawn boats, sometimes the pair consisted of steamer and consort, and sometimes even a second pair was towed by a long hawser trailing from the forward pair. The time saved in locking two boats at one operation and also in avoiding the necessity of uncoupling and refastening reduced the cost of carriage by a considerable amount. The law authorizing the first lock-lengthening required that it should be possible still to use the old lock for the passage of a single boat. This was accomplished by placing gates at the centers as well as at each end of the lengthened locks.

But the question naturally arises, Why should the people of the state have desired to improve the canals? Did they still have faith in them? We have seen how the pendulum had swung to the extreme of disaffection. Was there something more than sentiment behind the keeping of the main branches and then their improvement through three successive periods of enlargement? A brief review of the trade history of New York city will reveal one reason for making these canal improvements, perhaps the chief reason.

Confining our study entirely to the agricultural side we find that New York city early had added to her natural advantages other advantages almost as powerful in their determining influence on the trade of the country in favor of the metropolis. To mention only two — one the Erie canal, the other her financial preëminence in the country, the latter giving control of resources that enabled her to make immediate advances on all produce seeking its ultimate market through her port. Unquestionably the result of business originated by the canal was a period of uninterrupted progress and development lasting for over fifty years, a period of intense activity, of almost superhuman endeavor, of colossal enterprise, and of constant adjustment and readjustment to the needs of enlarging trade. During the

whole period, aided by these two advantages, New York maintained her proud supremacy. The open line of communication through her port with every part of the world and her ability to finance the movement of the crops of the country gave her every ascendancy in the grain trade and made her mistress of the flour and provision trades.

In the eighties, however, the commerce of New York began to feel the effect of the great economic and industrial changes that were taking place throughout the country. These changes revolutionized trade everywhere and in no place more than in New York. The advent of steam on the ocean; the extension of railroads on the land; improved financial conditions and facilities throughout the country; refrigerators and the introduction of the refrigerator car; the use of the telephone; the growth of the great milling and packing-house corporations, with their immense capital, splendid organization and extensive sales and distributing departments; all contributed toward the revolution in trade methods and resulted in opening many new channels for the steadily enlarging trade of the country.

To New York it all meant an active fight to hold the trade that formerly came to her without an effort on her part. Other ports began actively to compete for a share of her export trade. Western states began to assert themselves as trading centers. Canada became a formidable competitor. And, to cap it all, the railroads, pushed to the limit of their capacity by the enormous export trade of New York and by the demands of her constantly enlarging local business, sought to divert some of her heavy export traffic by establishing differential rates against her in favor of other cities, where it could be handled at less expense to themselves and with less interference with high-class freights. As a result, although New York still remains the great center of international trade, she has not made the relative trade gains in comparison with other ports.

This brief outline of general trade history shows the important part played by the waterways of the state in the development of its trade. It explains also the interest of certain men and organizations, especially the New York Produce Exchange, in canal affairs. It is estimated by experts and is generally conceded by all that grain and foodstuffs will furnish seventy-five per cent of the preliminary traffic on the Barge canal and this will practically all come consigned to members of the Exchange, to be inspected and distributed under its rules. It is no wonder then that the Exchange itself, as well as its members, when the old canal began to lose its real functioning

power as a result of changed conditions, started to agitate for a new canal capable of doing for New York under modern conditions what the old canal did for New York under former conditions. It was the old canal that originated and developed its trade and now when its trade is subject to assault on all sides it is the new canal to which it looks for help in maintaining it. As we shall see presently it was these New York business men, members of the Board of Trade and Transportation, the Produce Exchange and other similar organizations, who revived interest in the canals when favorable sentiment was at the lowest ebb and who have been at the forefront of all canal agitation.*

Before returning to the account of actual accomplishments in New York canal development, it is well to get a broad view of the whole field and consider for a little while what people had been and were thinking and what plans they were making in relation to the commercial situation as it then confronted them.

But first we must notice that a few years prior to the abolition of tolls a scheme of enlargement, known as the "Seymour plan," was enunciated, which, although it effected no change at the time, is noteworthy as showing a definite attempt at improvement. Also, a score of years later the channel actually was deepened somewhat after the idea proposed at this time by State Engineer Horatio Seymour, Jr.

The immense increase of traffic between the western states and the Atlantic seaboard had for several years made the subject of cheap transportation an all-important national problem. In December, 1872, the President had called the attention of Congress to it. A Senate committee, of which Senator William Windom was chairman, made a thorough and elaborate examination of the subject and reported † its findings to the Senate in 1874.

This report stated that New York State possessed the key to the commercial situation and that the [Erie canal had done more to advance the wealth, population and enterprise of the western states than all other causes combined. It went on to say that the canal had increased the value of the public lands and that the western grain regions were directly interested in the development, the improvement

* We are indebted to a member of the New York Produce Exchange for this review of the trade history. The main facts and several excerpts are taken from a paper read by Edward R. Carhart before the New York Waterways Association on November 21, 1919, and printed in the Tenth Annual Report of that organization.

† Report 307, 43d Congress, 1st Session.

and the maintenance of this waterway.] It was of supreme importance, the Committee deemed, that the people of the United States should sustain this vital regulator of freight charges. The Erie canal had earned for the State a generous income during its period of highest rates, from 1862 to 1869, when the tolls averaged $6\frac{1}{4}$ cents per bushel and they still paid when the tolls were reduced one-half, 1870 to 1874, and now that the State in a liberal spirit had abolished tolls entirely and thrown open the canal to the free commerce of the world, the only hope of the people against the united influence, power and capital of the railroads, said the Committee, lay in the Erie canal. It was directly beneficial to at least twenty million people in twelve western states and had proved that the greater the facilities the less was the cost of transportation.

Senator Windom, in a speech in the Senate in 1878, said that Erie canal rates exerted an influence over all other rates from the Gulf states to the St. Lawrence river and from the Atlantic ocean to the foot-hills of the Rockies. In support of this statement he introduced a letter from Albert Fink, Railway Trunk Line Pool Commissioner, than whom there was no higher authority in the United States on the transportation question, who said in substance that whenever rates from Chicago to New York were reduced by reason of the opening of the Erie canal season there followed a reduction from all interior cities, such as St. Louis, Indianapolis and Cincinnati, and that, if the direct lines from such localities did not at once meet the reduced water rates, their freights would reach New York by way of Chicago or other lake ports and the Erie canal and these direct lines would be left without business. The canal affected Boston, Philadelphia and Baltimore rates as well, continued Mr. Fink, and also the rates from South Atlantic ports and the southern states generally, until it reached the line of influence of low ocean rates, all rail rates in fact being kept in check by water transportation. The circumstances attending this statement, said Senator Windom, coming as it did from one who was then acknowledged as the best-informed railway manager in the country, gave it the binding force of testimony elicited under cross examination.

In this same Congress, the forty-eighth, first session, a bill to aid New York State in enlarging its canal by an annual appropriation of \$1,000,000 for ten years was reported. This measure, however, never became effective.

Canal men declare now that the freedom from tolls saved the canal, but just after their abolition even official opinion was divided



Flight of locks at Lockport, where the canal descends the Niagara escarpment. Two locks of Barge canal size have replaced a tier of five old locks. At the left appears the outlet of the power-supply tunnel around the locks.

and often was skeptical of the success of the venture. Governor Cleveland in his annual message to the Legislature of 1884 said that canal business in 1883, the first year of free canals, fully justified the policy of relieving commerce from the burden of the tolls. Comptroller Ira Davenport, however, in his report, attributed the increase to an unusually large general movement of freight through the state, railway traffic having increased also, with higher rates prevailing. The increase on the canal, he said, had been disappointing and there was no revival of interest in boat-building. But it remained for State Engineer Silas Seymour to declare free canals a failure and to voice his unqualified opinion, set forth in emphatic language, that the State waterways had outlived their usefulness and "it must be regarded as a foregone and inevitable conclusion that THE CANALS MUST GO."

With so keen an appreciation of the need of speedily solving the transportation problem and with the canal prospect so gloomy that even its friends were wavering, the time was at hand when some one should rally the forces of the canal advocates and spur them on to united and vigorous action. This rallying agent was found in the New York Board of Trade, which in 1884 called a State convention to consider what should be done in order to secure the permanent improvement of the State waterways.

This convention met in Utica in July, 1885, and organized "The Union for the Improvement of the Canals of the State of New York." Former Governor Horatio Seymour was chosen president, but he died within the year after his election and was succeeded by George Clinton of Buffalo, who was elected president at the second convention of the organization, which was held in Syracuse in 1886.

As we have just seen, at the time of organizing the Canal Improvement Union canal affairs were at a very low ebb. The people generally had come to look upon the waterways as of small importance and of but little and decreasing influence in the field of transportation. Even the friends of the canals were becoming disaffected and were inclined to oppose any efforts for improvement. The work of the Union, therefore, was to make the people see the true importance of canals and to restore them again to public favor. In this it succeeded admirably, even in the face of an opposition that was reinforced by the trunk line railroads, which had established a bureau from which anti-canal literature was sent unceasingly and by the millions of copies to all parts of the state. But the Union gained great strength, such strength indeed that by 1887 a leading New

York daily declared that it was "the most powerful and influential aggregation of commercial and manufacturing interests within the state of New York."

The Canal Union continued in existence for ten years. During that time the work of lock-lengthening was begun and completed and the project of increasing the depth of water to nine feet had been passed by the Legislature and approved by the vote of the people.

There is another occurrence which deserves a passing glance, since the men who were concerned voiced the most enlightened public thought and the most expert professional opinion of the day on the subject. In June, 1884, at the annual meeting of the American Society of Civil Engineers there was a discussion of the canal question, participated in by a score of prominent engineers. Elnathan Sweet, State Engineer of New York, led the discussion in presenting a paper on the subject of building a ship canal across the state. The project he outlined was a canal which should have 18 feet of water, a bottom width of 100 feet, and locks 450 feet long by 60 feet wide, and should be so located as to have a continuous descent from Lake Erie to the Hudson river. This discussion dealt not only with the ship canal but also with the whole broad state waterway question. It effected no result of course, except as it helped to mold public opinion, but it is significant in showing the trend of thought which later became crystalized in actual accomplishment.

To return to the account of what was being accomplished on the canal, we note that for a period of about ten years, commencing with 1884, the project of lock-lengthening was in progress. During this time forty of the seventy-two Erie canal locks were lengthened and twelve of the twenty-three Oswego locks. This work was continued up to almost the beginning of the next improvement, which was a comprehensive scheme of canal enlargement known popularly as the "nine-million-dollar" improvement, the general plan of which was to deepen the canal to nine feet. During the nine-foot deepening, moreover, a little work of the earlier character was done, six more locks being lengthened on the Erie and one on the Oswego.

A certain act of the Legislature of 1892 is noteworthy because of its far-reaching effect in shaping the canal policy of the future. It authorized the election of delegates to a Constitutional Convention which met in 1894, one of its duties being the consideration of amendments relating to the care and improvement of the State canals.

The lengthening of locks had its place in canal development, but

at most this slight improvement was not adequate to the needs of the time. It expedited the transit of boats but it did not increase their capacity. To enable the canals to compete with their rivals it seemed evident that the channel must be made larger. The first scheme of this character to be tried was a deepening from the existing seven feet to a proposed nine feet. This was really a modification of the "Seymour plan," which in its original form called for an increase of at least one foot in depth.

Canal advocates hoped that this contemplated improvement, which they had secured only after much labor, would meet the needs of water transportation for a number of years to come. We know, however, that even two or three years before construction was authorized a plan very much like the next succeeding enlargement had been proposed by State Engineer Martin Schenck as the practical canal of the future. Mr. Schenck gave expression to this opinion in his annual report for 1892. This report is worthy of attention not only because it contains this first official presentation of a scheme of enlargement which in general closely resembles the Barge canal project but also because there is revealed a clear insight into the reasons for such a canal — the same reasons in substance which led the Canal Committee in 1900, after making an exhaustive study of the subject, to recommend to the State the building of what has come to be known as the Barge canal. The immediate occasion of discussing this topic was the measure then pending before Congress to appropriate \$100,000 for the purpose of making a survey for a ship canal from the Hudson river to the Great Lakes. A little later, as we shall see presently, the Federal government did authorize this survey as a part of the undertaking known as the Deep Waterways Survey. In his discussion the State Engineer favored the proposed survey because of the valuable information it would furnish, but a ship canal, he deemed (and we quote his apt phrasing), was only a pleasing idea to contemplate and not a practical plan to consummate. The use of three types of vessels — lake, canal and ocean — in shipping goods from the Lakes to Europe was a state of affairs, he thought, which was likely to exist for years to come. Also ocean steamers could not with economy navigate the canal, and lake vessels could not compete with ocean liners in transporting cargoes to Europe.

In announcing his solution of the problem he said, "The practical canal of the future, connecting Lake Erie and the Hudson river, ought to be one capable of bearing barges 250 feet in length by

twenty-five feet breadth of beam, of a draft not to exceed ten feet and of such height that the great majority of bridges that shall span this canal may be fixed structures instead of draw bridges. With this proposed canal (which can be built for a reasonable sum) bearing barges towed in fleets, each boat carrying 50,000 bushels of wheat, New York will be enabled to hold her commercial supremacy against all comers for many years to come."

In passing we should notice that in this same report the State Engineer called the attention of the Legislature to a set of very conservative and wise resolutions adopted by a canal convention held in Buffalo on October 19, 1892, relative to enlarging the canal prism. The demand for a larger canal seemed imminent and he recommended that funds be provided to enable him to make a survey of the Erie canal from which to make plans for increasing the depth of water to nine feet. If this suggestion had been heeded there would have been something better than the antiquated survey of 1876 on which to base an estimate of cost for deepening the canals to this same depth, nine feet, when the Constitutional Convention of 1894 called upon the State Engineer and gave him only twelve days in which to prepare such an estimate, and much of the trouble attending the nine-foot enlargement might thus have been averted.

In his annual report the next year State Engineer Schenck described more in detail his idea of the canal of the future. Its depth was to be 12 feet, the same as later chosen for the Barge canal, and the width 100 feet at water-line. The route, however, was to be practically the same as the existing canal and in this respect it differed from the Barge canal, which has left the old alignment and follows and canalizes many of the natural streams.

But to return to the nine-million-dollar improvement. Little regarding its details need be said here, since in this review of canal history prior to the beginning of actual Barge canal agitation we are concerned chiefly with the larger aspects of the various events, and these we are studying simply to learn what influences led up to and were instrumental in bringing about the building of the Barge canal.

Briefly it may be said that the Constitutional Convention met in May, 1894, and among the amendments it approved was one which provided that the canals might be improved in such a manner as the Legislature should decide and that a debt might be authorized for that purpose or the cost might be met by appropriating funds from the State treasury or by equitable annual tax. Although this amendment conferred upon the Legislature no powers in addition to those

it possessed under the existing constitution, it was considered that the vote at the ensuing November election would reveal the popular attitude and if favorable would be in effect a mandate to the Legislature to undertake the improvement of the canal.

This Convention called upon the State Engineer for estimates of cost for deepening the canal to nine feet. For several years the State Engineers had been urging the Legislatures to appropriate money for a survey upon which to base this very estimate, but without avail. We have noted one of these recommendations — made by Mr. Schenck. Lacking the information which this survey would have furnished, State Engineer Campbell W. Adams made what use he could of the old and entirely inadequate survey of 1876 and prepared his estimate within the allotted time, only twelve days, but stated it was merely a guess, assuming all conditions to be favorable. The amount was \$11,573,000, with an additional million needed for repairing and rebuilding walls.

The people approved the canal amendment in 1894. The Legislature of 1895 passed a referendum for deepening the canal to nine feet, naming nine million dollars as the amount to be expended. This sum was arbitrarily fixed by the Legislature and without consultation with the State Engineer. Probably it was believed to be all the people would be willing to authorize at the time. This measure in turn was approved by popular vote at the general election of 1895. The statute required work to be commenced within three months. As soon as possible, by January 13, 1896, twenty-eight parties began surveys over the entire length of the Erie, Champlain and Oswego canals, a distance of 454 miles. The plans and estimates were prepared. The probable cost as shown by these estimates was thirteen and a half millions, or fifteen millions with engineering, inspection and advertising added. A later revision made the total sixteen millions.

Although there were only nine millions to expend, construction was begun. By cutting out certain pieces of work it was hoped to bring the cost within the amount of money available. This hope, however, proved to be without foundation and by the latter part of 1897 it began to be realized, first by those connected with the work and then by the public generally, that the proposed improvement could not be completed within the appropriation. And with these reports came rumors of alleged frauds and extravagance in administering and prosecuting the enterprise.

With the sudden stoppage of work, the inquiry of an investigating commission into the expenditures, the severe criticisms, the bitter controversy taken up by the public press, the later legal examinations and opinions to fix the responsibility and determine whether criminal proceedings should be started, with these things we need not now concern ourselves. What we do need to know, however, is that the appropriation was exhausted, the work of deepening less than two-thirds completed and the people of the state keenly disappointed; also that they were distrustful of all things and everybody connected with the canal and were bewildered as to what to do next.

It is worthy of note that the investigating commission, although in its report it criticised the way in which the improvement had been carried on, had only words of praise for the canal itself, calling attention to its high value as the cheapest means of transportation and recommending the continuation of the improvement regardless of its cost.

Before the Legislature of 1898 had ordered the appointment of a commission to investigate the nine-million improvement, it had before it two measures which call for our passing attention. One was a referendum bill for raising seven millions to complete the work then in progress, this sum being the State Engineer's estimate. The other was a proposition to turn over the canals to the Federal government. This latter measure raised a storm of protest and when it came to vote was defeated by a large margin. The bill to raise seven millions was not pressed to a vote, canal advocates deeming it wise in view of the forthcoming investigation to let the matter drop.

CHAPTER II

A BROAD OUTLOOK AND THE CONTRIBUTION OF FEDERAL INVESTIGATIONS

Congressional Reports—General Activity—New York Survey for Ship Canal—The Ship Canal Idea—International Deep Waterways Commission: Summary of its Report: Its Recommendations—Board of Engineers on Deep Waterways: Surveys and Report: Costs and Dimensions: Relative Advantages, 21-Foot and 30-Foot Channels: Route Favored: Ship and Barge Canals Compared: New York Route Preferred to St. Lawrence—Col. Symons' Investigation on Ship and Barge Canals: Conclusions and Influence.

WHILE the State had been thus engaged in lengthening its canal locks, in attempting a subsequent enlargement and later in investigating what it had done, the question of adequate water transportation between the Lakes and the seaboard was still an unsolved national problem of supreme importance, concerning which discussions and agitation had been going on continually.

In Congress, in 1889, a revision of former estimates and surveys was made by Captain Carl F. Palfrey, Corps of Engineers, U. S. A., for a 21-foot canal on two routes from Lake Ontario to Niagara river. This was published in the report of the Chief of Engineers for 1889. A bill was introduced in Congress the same year providing for a commission to select one of these routes and appropriating one million dollars, but was not acted on. In 1890 a report with maps, profiles and revised estimates was made by William Pierson Judson and published in H. R. No. 283, 52d Congress, 1st Session, 1892. The estimates were for two routes from Lake Ontario to Niagara river and for 21 feet depth of water. Other reports were also made to Congress—in 1890 by Representative Sereno E. Payne, in 1892 by Representative C. A. Bentley and in 1896 by Representative C. A. Chickering and Senator Calvin S. Brice, in each of which the commercial and engineering aspects of the case were fully presented and favorably discussed. In February, 1892, the subject of ship canals across New York state, by both the Ontario and the Erie routes, was under consideration by Congress and Major Dan C. Kingman, Corps of Engineers, U. S. A.,

presented a general statement of the plans and estimates that had been made up to that time and of the existing conditions and costs.

At numerous waterway conventions and meetings of engineering societies papers were presented and the subject was discussed in all its aspects. Many articles were published in technical and popular periodicals, and editorials frequently appeared in the newspapers. Of this large amount of information that was continually being disseminated we need not mention specific examples.* The topic of better and cheaper transportation was of sufficient public interest to demand a goodly supply of literature and frequent discussion, and the people gladly read and heard what those who knew about the subject had to tell.

About this time the question of a ship canal between the Lakes and the Atlantic came prominently to the front and the subject took on more of an international complexion than ever before. In 1892 the Congressional committee on railways and canals recommended a survey for a ship canal from the Lakes to the navigable waters of the Hudson river. In September, 1894, a convention of mercantile exchanges was held at Toronto, Canada, in which delegates from the western cities in the grain belt participated. These are merely two incidents which are indicative of what was happening.

During the same period the Canadian government was contemplating an increase in size of its canal system, even up to the dimensions of a ship canal. On some of its branches a smaller enlargement was actually begun. Also the Georgian Bay ship canal project was launched, and this route would shorten the haul between Lake Huron and tide-water by hundreds of miles. In later years the survey for this canal showed 282 miles less distance between Sault Ste. Marie and Montreal than by the Lakes and St. Lawrence route. The plans made from this survey call for a 22-foot channel.

In New York state, even while the measure for deepening to nine feet was pending, the first steps towards a still larger channel were taken. On August 24, 1895, State Engineer Campbell W. Adams directed Albert J. Hines, Resident Engineer on the Eastern Division, to make an examination for an enlarged canal along what was called the Oswego route. It was in March of this year that the Legislature had passed the bill for the nine-foot deepening and the people were preparing to vote on it in November. The report on this examination states that it was undertaken because the great

* See Bibliography in *History of the Canal System of the State of New York, etc.*, for list of some of these publications.

interest in enlarged canals manifested by the recent convention of the Deep Waterways Association and by the citizens of New York state in the late election had made it desirable to obtain better information than had heretofore been available about the cost of a work such as the one proposed. The route extended from the Hudson river at Watervliet to Lake Ontario at Oswego, following the Mohawk river to Rome and going thence down Wood creek and across Oneida lake and on by a cross-country line to the Oswego river near Phoenix and then down the Oswego to the lake. In making the estimate of cost it was considered that the canal would have a bottom width of 100 feet and a depth of 20 feet of water and that the locks would be 450 feet long by 60 feet wide. The estimate was \$82,098,601.

As we have just said, the ship canal idea was growing in prominence and public favor. One who was closely associated with the whole waterway movement, Col. Thomas W. Symons, in writing of the two projects that were before the people in 1895 — the nine-foot deepening of the New York canals and the ship canal scheme — says of the latter:

"The other movement was much more widespread, but had not reached the era of actual work. It was the agitation and demand throughout all the region of the Great Lakes and a goodly portion of the Atlantic seaboard for a ship canal connecting the lakes with the sea. Many letters were written to the press, favoring the project. The newspapers of the region had many articles and editorials in the same line. Numbers of public meetings were held and enthusiastic speeches made for the ship canal project. Orators and writers depicted the magnificence of the future when great ocean ships should leave Liverpool and other foreign ports and proceed directly to Chicago, Duluth and all the other chief cities of the lakes bringing the commercial productions of the world and exchanging them for the grains, lumber, ore, etc., of the Northwest, right in the heart of the continent. Some, more conservative, were content with the idea of a canal which would permit the ships of the Great Lakes to reach the seaboard and there deliver their loads to the people of the coast or exchange their foreign-bound cargoes with the deeper draft ships engaged in ocean commerce. The glamor of the Ship Canal from the Lakes to the Sea, like a brilliant aurora borealis, shone brightly over the whole lake region." *

* *Buffalo Historical Society Publications*, Vol. XIII, p. 122.

Under the inspiration of this wide-spread movement an international Deep Waterways Commission was created, to "make inquiry and report," to use the language of the United States Congressional resolution, "whether it is feasible to build such canals as shall enable vessels engaged in ocean commerce to pass to and fro between the Great Lakes and the Atlantic ocean." By a law of March 2, 1895, Congress authorized the appointment of three persons who should meet with any similar committee appointed by Great Britain or Canada. On November 4 the President announced as his appointees, James B. Angell of Ann Arbor, President of Michigan University, John E. Russell of Leicester, Mass., prominent in politics in his state and a student of public affairs, and Lyman E. Cooley, C. E., a well-known engineer of Chicago. Soon afterward Canada appointed Oliver A. Howland, M. P. P., of Toronto, Thomas C. Keefer, C. E., of Ottawa, Past-President, American Society of Civil Engineers, and Thomas Monro, C. E., of Coteau Landing.

These commissioners served without pay and had but little money for expenses, not enough for comprehensive surveys, but they made a very thorough examination of the subject committed to their charge and presented a report filled with valuable information. The Commission presented its report on January 8, 1897, and the President in turn transmitted it to Congress a few days later, January 18.

From the wording of the Congressional resolution, already quoted, it appears that the chief duty of this commission was to determine the feasibility of a ship canal between the Great Lakes and the Atlantic seaboard. The commission was required further to report whether there was an adequate water-supply, where the canals might best be located, what the probable cost would be and what treaty arrangements would be necessary if any part of the canals should lie in Canadian territory.

This dream of a ship canal to the heart of the continent has been a most persistent idea in the minds of a large part of the American people. As we shall see presently a certain investigation ordered by the Federal government in 1896 convinced many persons that a barge canal was preferable to a ship canal and the ship canal idea lay quiescent for nearly a score of years, all through the period of constructing the New York State Barge canal, but recently it has been revived and now again, in the Middle West especially, is in full vigor. It is well then for us to consider carefully the findings of this commission, since it was created for the express purpose of rendering a careful, well-informed and just opinion on the ship

canal question and moreover was composed of broad-minded men capable of rendering such an opinion. To avoid any possibility of wrong interpretation, we shall quote the report verbatim:

"After considering this question in its various aspects," say the commissioners, "we conclude—

"First. That it is entirely feasible to construct such canals and develop such channels as will be adequate to any scale of navigation that may be desired between the several Great Lakes and to the seaboard, and to conduct through the same domestic and foreign commerce, and that, in our opinion, it will be wise to provide for securing a channel of a navigable depth of not less than 28 feet.

"Second. That starting from the heads of Lakes Michigan and Superior, the most eligible route is through the several Great Lakes and their intermediate channels and the proposed Niagara ship canal (Tonawanda to Olcott) to Lake Ontario; and that the Canadian seaboard may be reached from Lake Ontario by the way of the St. Lawrence River, and the American seaboard may be reached from Lake Ontario by way of the St. Lawrence River and Lake Champlain and the Hudson River, or by way of the Oswego-Oneida-Mohawk Valley and the Hudson River.

"Third. That the alternative routes from Lake Ontario to the Hudson River require complete surveys and a full development of economic considerations to determine their relative availability.

"Fourth. That moderate control of the level of Lake Erie and of the Niagara River above Tonawanda may be justified in connection with the Niagara ship canal, the determination in this matter to rest on a full examination of the physical conditions.

"Fifth. That the policy should contemplate the ultimate development of the largest useful capacity, and that all works should be planned on this basis, and that the actual execution should conform thereto, except in so far as the works may, without prejudice, be progressively developed with the actual demands of commerce.

"Sixth. That it is practicable to develop the work in separate sections and the several sections in part by degrees, each step having its economic justification, so that benefits shall follow closely on expenditure, without awaiting the completion of the system as a whole.

"Seventh. That the completion of the entire system as quickly as proper projects can be matured and economically executed is fully justified.

"Eighth. That the Niagara ship canal should be first undertaken, and incidentally the broadening and further deepening of the inter-

mediate channels of the lakes, the same being in the logical order of development, and also requiring the least time for consideration.”*

In order that the examination might be carried on to completion the commission made several recommendations, the result of which was the creation of a Board of Engineers on Deep Waterways. Since these recommendations became in effect the instructions under which this board of engineers undertook its work, we shall quote such of them as are pertinent, as follows:

“I. That complete surveys and examinations be made and all needful data to mature projects be procured for —

“(a) Controlling the level of Lake Erie and projecting the Niagara ship canal.

“(b) Developing the Oswego-Oneida-Mohawk route.

“(c) Developing the St. Lawrence-Champlain route.

“(d) Improving the tidal Hudson River.

“(e) Improving intermediate channels of the lakes.

“II. That the collecting and reducing of existing information, supplemented by reconnoissances and special investigations, be continued until the general questions have been fully covered.

“III. That a systematic measurement of the outflow of the several lakes and a final determination of their levels shall be undertaken.”†

Under act of June 4, 1897, the President appointed a Board of Engineers on Deep Waterways. It consisted of Lieut. Col. Charles W. Raymond, Corps of Engineers, U. S. Army, and Alfred Noble and George Y. Wisner, two well-known engineers in civil life. The act directed the Board to make the surveys and examinations in accordance with the recommendations we have just noted, and a later act, that of July 1, 1898, specified that the estimates of cost should be for canals of 21 and 30 feet depth, respectively, to be accompanied by a statement of the relative advantages of each.

The task set the Board was immense and several years were required for its performance. A large corps of engineers was employed and thorough surveys and estimates were made. A total of \$485,000 was appropriated for the expenses. The report of the Board, which is dated June 30, 1900, was transmitted to Congress by the Secretary of War on December 2, 1900, and is most elaborate and complete in every detail.

Since this is the report of supreme authority on the subject of a ship canal between the Lakes and the Atlantic and also because its

* House Document No. 192, 54th Congress, 2d Session, pp. 29, 30.

† *Id.*, p. 30.

influence was ever present in the agitation for the Barge canal it will profit us to scan its pages thoughtfully. As an interesting sidelight we notice that many of the engineers engaged in this investigation, from two members of the Board down to those in the humbler ranks, were later employed on the Barge canal, either the preliminary surveys or the subsequent construction, the writer of the present volume among the number.

For our present purpose we need not look at more than the conclusions of the Board, but the details of its work have been of much value to New York State, first in assisting the State Canal Committee in its investigations in 1899 and then in helping the State Engineer in his survey in 1900, when they obviated many miles of surveys which otherwise would have been necessary, and later in the planning and construction of the Barge canal.

With the exception of the investigation into the relative merits of the 21- and the 30-foot channels the duties of the Board, as specified by the creating act, were of a purely engineering character and did not include the consideration of questions of Government policy or commercial desirability. In general the Board confined itself strictly to these prescribed duties, just hinting at something more.

The surveys covered two routes between Lakes Erie and Ontario, one from Lasalle to Lewiston and the other from Tonawanda to Olcott; also two routes from Lake Ontario to tide-water, one by way of the St. Lawrence river, Lake Champlain and the Hudson river, the other by way of Oswego river, Oneida lake, Mohawk river and Hudson river. Along the later course there were estimates on both a high-level plan and a low-level plan. The Board favored the Lasalle-Lewiston route and the Oswego-Mohawk low-level plan. The estimated cost of a 21-foot canal from Duluth to New York by the Lasalle-Lewiston-Champlain route was \$190,382,436, and by the Lasalle-Lewiston-Oswego-Mohawk low-level route, \$206,358,103. A 30-foot canal between these two points would cost \$320,099,083 and \$317,284,348 by the same respective routes. Estimates from Chicago to New York were also given — \$5,495,379 less for the 21-foot channel and \$17,313,321 less for the 30-foot channel.

If these figures are to be compared with the costs of other projects, it must be remembered that prices of materials and labor have undergone a vast change since the time these estimates were made. Probably also in the event of construction many contingencies would have arisen to increase them. In writing of these estimates as long

ago as 1909 Col. Symons said, "A study of the board's detailed estimates and recent experiences on the New York State barge canal construction, the increased cost of labor and materials since the report was completed, and the infinite complications which would arise to vested interests and properties in doing such a work, indicate very clearly to me that these estimates would have to be largely increased, probably by from 25 to 50 per cent." Moreover, if the canal had been built, the lake harbors would have had to be deepened to accommodate sea-going vessels and this work would have added many millions to the sums contained in these estimates.

The channel widths on which the estimates were based were as follows: For the 21-foot depth in earth section, 215 feet bottom width with side slopes two on one with a bench ten feet wide on each side five feet below water-surface, a wash wall to line a further two on one slope from these benches to other benches ten feet wide at five feet above water-surface. Any excavation above these latter benches was to have the same two on one slope. The area of this cross-section is 5,497 square feet. In rock section for the same depth the average width was 240 feet at bottom with slopes of one on ten. At five feet above water-surface was a ten-foot bench with a further one on ten slope to the top of the rock cut. If there were earth excavation above that, it had a two on one slope, footing at the back of another ten-foot bench. The rock cross-sectional area was 5,040 square feet. For the 30-foot channel these same descriptions apply to the side slopes, but the earth section had a bottom width of 203 feet and the rock section an average width of 250 feet, the areas being 7,990 and 7,500 square feet, respectively.

Single locks designed for the 30-foot waterway were 740 feet long and 80 feet wide. If flights of locks were necessary, a duplicate set having a width of 60 feet was provided. For the 21-foot channel the locks, whether single or double, were 600 feet long and 60 feet wide.

In trying to answer the question as to the relative advantages of channels of 21 and 30 feet depth the Board divided its study into two parts and considered first the direct benefits and then the indirect benefits. The conclusion was that the return in direct benefit was much greater from the 21-foot waterway than from the 30-foot waterway. It appeared also that in indirect advantages the 21-foot canal promised a much greater return of value relatively to its cost than the 30-foot canal, the main superiority of the larger channel being that it would furnish the lowest cost of transportation to

foreign markets and would permit the construction of ocean vessels at Great Lakes shipyards.

There are two things in this report which, because of their bearing on subsequent Barge canal agitation, we should notice particularly. The Board said that the most favorable route for a 30-foot waterway from the Lakes to the sea was by way of the Oswego and Mohawk valleys and that this same route was practically as favorable as any for a 21-foot waterway. Moreover this route had the added advantage of being wholly within United States territory, of having a longer season of navigation than the more northerly line, of having a much simpler problem of defense than a canal lying partially in a foreign country and of being available as a line of communication for ships of war. It will be observed that the Oswego branch and the easterly half of the Erie branch of the Barge canal follow the general alignment chosen by the Deep Waterways Board.

Throughout the fierce conflict between canal and anti-canal forces over the Barge canal project the ship canal scheme and this Deep Waterways report were ever being brought forward in argument against the 1,000-ton waterway. There was a reason for selecting the barge size of channel as the New York canal policy and those who were responsible for making this selection thought that it was a good and sufficient reason. We need not discuss this reason now; a full account of the matter will appear presently, but briefly it was that investigation had shown that transportation by barge canal, including two transfers of cargo, was cheaper than by ship canal with no transfer. But while we are reviewing this report we should see just what the Board had to say in regard to the subject.

"It is easily conceivable," reads the report, "that a barge canal of moderate dimensions, requiring transfers at Buffalo and New York, might be of more direct benefit to the State of New York than a canal of sufficient dimensions for the uninterrupted passage of ships; but much of this benefit would be at the expense of the producers and shippers of other parts of the country." *

On the other hand the report says, "It is, however, considered by high authorities very doubtful whether a vessel can be so constructed as to navigate successfully and economically the ocean, the lakes, and the canal. The ocean vessel must be stronger than the lake vessel, and more costly in construction, operation, and maintenance, and it

* House Document No. 149, 56th Congress, 2d Session, p. 125.

must be fitted with expensive appliances which are not required in the lake traffic." *

If we did not know who was speaking in this latter quotation, we might reasonably think that we were listening to a barge canal enthusiast expounding the basic reason for his advocacy of a barge rather than a ship canal. Surely the two quotations do not seem entirely consistent.

Two other quotations from this report are of especial interest, particularly in view of the recent revival of the ship canal project. These excerpts give the Board's reason for its opinion as to which route is best for a canal between the lakes and the sea.

"The project for a waterway from the lakes to the Atlantic suitable for transporting the commerce of the upper lakes," says the report, "has prominently attracted public attention for nearly a century, during which time the citizens of New York have maintained that such waterway must be built directly across the State, as an aid in building up the financial and commercial supremacy of New York City, while the people farther west have insisted that the canal should be constructed on the route best adapted for transporting the commerce of the country tributary to the lakes."

Then after mentioning an incident of 1812 not pertinent to our present study, the report continues:

"It was then, and is still, openly admitted that the St. Lawrence River is the natural outlet and the line of least resistance for a waterway from the Great Lakes to tide water, but that for New York State to permit such canal to be built would be to commit commercial suicide.

"The advocates of this theory have left out of consideration the fact that the larger portion of the commerce between the lakes and tide water is of a domestic nature and that the only benefits to be derived from export traffic through a port are those from levying tribute on the foreign commerce of a neighboring State.

"It is an established fact that a waterway of sufficient capacity to transport the tonnage of the lakes to the sea can be constructed via Lake Ontario for less cost than by any other route, and that a steamer will traverse it in about three-quarters the time required on a direct waterway of similar dimensions from Lake Erie to the Mohawk at Utica. If, therefore, the object desired is to develop a waterway which will best subserve the interests of the lake commerce,

* *Id.*, p. 123.



Lock at Little Falls—40½ feet lift. Highest lift lock in the world when construction was begun. A side pool at the left—to utilize part of lockage water for two lockages. Lower gate of the lift type, and an arch spanning the chamber.

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it is apparent that the route should be through Lake Ontario and that a ship canal from Lake Erie to Lake Ontario should be an essential part of it."*

There was one particular investigation, however, that was made under Federal authority a little earlier which had more to do with shaping the New York canal policy than any other examination or survey, either Federal or State. This investigation was made by Major Thomas W. Symons, later Colonel, Corps of Engineers, U. S. A., retired, who had come to Buffalo in 1895 to take charge of the Federal river and harbor work in the vicinity. Although the act of Congress authorized primarily an examination and estimates for constructing a certain type of canal, Col. Symons extended his studies into the realm of comparative costs of transporting by ships and canal barges and thus acquired definite information on a subject in which there had been before no authoritative data. In writing of this investigation Col. Symons describes so well the parts of it which became the controlling influence in determining future action that we are quoting from him at some length.

Referring first to the report of the Board of Engineers on Deep Waterways, Col. Symons says:

"This elaborate and expensive report on the ship canal question on its presentation and publication fell flat and has scarcely been heard from since except to use some of its findings and statements for contentious purposes, and its maps and data for other canal projects. No official effort to bring it up or to cause its suggestions or recommendations to be carried into effect was ever made. The apparent reason for this practical obliteration of the ship canal from official consideration was the fact that while it was in progress the question of the relative economy and efficiency of ship and barge canals was studied and analyzed by the writer and others and found to be largely in favor of a barge canal.

"The River and Harbor Act of June 3, 1896, contained the following provision:

"'The Secretary of War is hereby directed to cause to be made accurate examinations and estimates of cost of construction of a ship canal by the most practicable route, wholly within the United States, from the Great Lakes to the navigable waters of the Hudson river, of sufficient capacity to transport the tonnage of the lakes to the sea.'

* *Id.*, pp. 50, 51.

"The work was placed in charge of the writer by letter from the Chief of Engineers, dated August 13, 1896, and the report called for was submitted June 23, 1897.

"The gist and greatest value of the report consists in the careful investigation that was made into the cost per ton of carrying capacity of lake ships and canal barges, and the cost of operating the same. These costs, with the items of transfer at Buffalo, insurance on vessels and cargoes, interest on investment and deterioration, all reduced to a single unit of freight, enabled a comparison to be made between the economy and efficiency of a ship canal and a barge canal.

"It was roughly estimated that the ship canal would cost \$200,000,000 and the barge canal (Erie alone) \$50,000,000. The estimated cost per ton of carrying capacity of steel lake freighters was determined to be from \$35 to \$50, while the cost per ton of carrying capacity of canal barges, including a steamer with each fleet, all suitable for navigating the canal, was \$10 to \$20.

"With everything reduced to the same basis, it was calculated that the cost of transporting a bushel of wheat in lake freighters of 7000 tons capacity through a suitable canal from Buffalo to New York was 2.28 cents, while the cost of transporting the same bushel in a fleet of barges, each carrying 1500 tons, through a suitable barge canal from Buffalo to New York, and including the transfer charges at Buffalo was 2.07 cents, and if the transfer charges were reduced, as they have since been reduced, was 1.66 cents.

"In making this comparison no consideration was given to the cost of the canal or the cost of operating it, the basis of comparison being the interest on the cost of carriers, deterioration thereof, insurance of carriers and cargoes, ordinary repairs, fuel, oil, and waste and the wages and subsistence of the crews of the vessels. If the first cost of the canal and the cost of maintenance and operation were taken into consideration, the showing in favor of the barge canal over the ship canal would have been still more marked.

"The study was convincing that for the highest economy in transportation, special types of vessels are needed for use on the ocean, on the lakes, and on the canals, and neither can replace the other in its proper waters without suffering loss of economical efficiency. Ocean vessels could not, as a general rule, engage in the business of passing through a ship canal and the lakes to the upper lake ports, and lake vessels are not fitted for use upon the ocean, and if they made use of a canal they would have to transfer their cargoes at the seaboard, ordinarily by means of lighters, floating elevators, etc., at a higher

expense than such transfers would cost at the lower lake ports. For economical transportation through a canal from the Great Lakes to the sea special vessels, differing from and far less costly than ocean or lake vessels, are required.

"The conclusion was reached by the writer that even if a ship canal were built, the greater cheapness of barge canal transportation would prevent its use by large ships, and cause it to be used almost entirely by fleets of barges which could be almost equally as well accommodated in a smaller and cheaper canal.

"The report was submitted June 23, 1897, and published in the Report of the Chief of Engineers for 1897. No action was taken on it by the General Government, but it had an important influence in shaping public opinion in New York, in killing the ship canal idea, and in furnishing a standard about which the canal interests of New York could rally. The \$9,000,000 fiasco, the dazzling pictures of the ship canal advocates, and the dismal pictures of the enemies of all canals, had produced a state of bewilderment in regard to the canal questions. The report advocating a barge canal for boats of about 1500 tons capacity cleared things up, and was a solution of the problem which was received with favor and grew in estimation, until it was finally adopted by the State and, with modifications, is now being carried out." *

It will be well to remember these words of Col. Symons. They explain the basic principle which governed the choice of a barge rather than a ship canal across New York state. In the maze of events and discussions that took place before the people finally decided what course to pursue we may lose sight of the influence Col. Symons' investigation had on the whole question. Col. Symons was a member of the committee which later formulated the State canal policy and thus was able to give the State the full benefit of his earlier researches.

* *Buffalo Historical Society Publications*, Vol. XIII, selected paragraphs on pp. 124-129.

CHAPTER III

SEEKING A CANAL POLICY

New York Commerce Commission Appointed—Groping for a Canal Policy—Canal Advocates Attempting to Rally—Opposition and Discouragement Found Everywhere—Suggested Remedy—State Committee on Canals Appointed—Call for a State Commerce Convention—Results of Commerce Convention—Work of State Committee on Canals—Its Report: Recommendations: Other Alternatives, Canal Abandonment and Ship Canal: Abandonment Discussed: Ship Canal Discussed: Estimates—Commerce Commission Reports—Governor's Message Transmitting Reports of Canal Committee and Commerce Commission—Commerce Commission's Report: Commerce Decline Due Largely to Differentials: The Remedy, Canal Improvement: Recommendations.

AFTER this rather lengthy digression into the national aspects of the waterway problem we return to events in New York state. Just as the work of deepening the canals to nine feet was coming to a close a commission was appointed by Governor Black which had a distinct bearing on the canal policy the State was later to adopt. This body was known as the New York Commerce Commission and it consisted of five members, Charles A. Schieren, ex-Mayor of Brooklyn, Andrew H. Green, C. C. Shayne, Hugh Kelly and Alexander R. Smith. In his annual message to the Legislature the Governor had recommended such a commission and under a legislative act of April 29, 1898, he was given authority to appoint it. The duty of this commission was to inquire into the condition of the commerce of New York, the causes of its decline and the means for its revival, also to summarize its conclusions, suggest advisable legislation and report to the Legislature of 1899. On January 18, 1899, the commissioners reported that, owing to a defect in the creating statute, they were without funds properly to carry on their investigation, and they recommended the continuance of the commission and an appropriation for doing the work. In his message to the Legislature Governor Roosevelt endorsed this recommendation. As a result the commission was granted an extension of time and a fund for expenses. The work done by this commission was most excellent. Its report to the Legislature, which contained an abundance of valuable data, was submitted in 1900, almost contemporane-

ously with the report of the State Committee on Canals. We shall review the commission's report as we reach it in due chronological order.

We have said that after the failure of the nine-million plan the people of the state were bewildered as to what to do next. The same may be said of the political leaders and of the canal advocates as well, as we shall see presently. Governor Roosevelt's annual message to the Legislature of 1899 shows that in canal matters he was feeling his way. He said little of importance on this subject except that he would send a later communication.

The nine-million-dollar improvement had been carried on under a Republican administration. It followed naturally that all of the malodorous publicity, the adverse criticism and the charges of fraud and extravagance connected with the undertaking were eagerly seized upon by the opposing political party and used for partisan ends, and the effect was felt at the polls in the general election. Another Republican administration, however, came into office in 1899, but with the pall of the old administration still clinging to it. The new leaders felt it incumbent on them, therefore, not only to do their duty by the State but also in some way to retrieve the good name of their party.

With a considerable sum spent for improvement and the waterways no better fitted than before to handle a larger through traffic, the canal question could not be ignored. The people were in no mood to temporize and they expected some definite, constructive policy. And so it is that we find canal advocates beginning anew during the winter of 1898-99 to rally their forces for further contest. And we find too the State officials seeking information to guide both themselves and the people at large in determining what was the best thing to do.

The New York Board of Trade and Transportation and the Buffalo Merchants' Exchange have been at the forefront of the canal battle line for the past quarter century and more. At this juncture it was the New York organization, and particularly its indefatigable canal workers, Frank S. Gardner, secretary, and William F. McConnell, assistant secretary, that first joined the fight. In the fall of 1898 the Board, fearing that grave danger threatened the very existence of the State canals, appointed a special committee to confer with other commercial organizations and with the friends of the canal generally throughout the state for the purpose of reviv-

ing the sentiment for canal improvement and, if advisable, calling a State canal convention.

In the following winter the Board sent Mr. McConnell on this mission through the state, but the effort proved an entire failure. In a report to the Board a year later the committee on canals said that "on the first day of January, 1899, the canal improvement movement seemed dead beyond hope of resurrection. The temper of the people and the Legislature forbade any attempt at legislation looking to a continuance of the improvements. The policy of the Governor was undefined. With a view to revive interest, this board sent Mr. Wm. F. McConnell to visit representative men and organizations in the interior of the state. Emphatic opposition and discouragement were found everywhere. The old friends of the canals had lost heart, and many of them were openly opposed to any further attempt to save the canals. We were unable to secure a single promise from any organization or individual for coöperation in an attempt to revive the canal movement. At that time the secretary of the board suggested the calling of a State convention on the broader ground of State commerce. He contended that State commerce embraced canal commerce; that the canal question would necessarily become prominent in any discussion of State commerce, and he predicated that the canal question would thereby be revived and possibly become the overshadowing topic in any representative gathering of the business men of this State. It was conceded everywhere that something must be done for our commerce, but no plan or policy had been formed, no measure outlined."

The Canal Improvement Union, which came into being in 1885, had been allowed to go out of existence with the beginning of the nine-million improvement. With no prospect of reviving this Union or of forming any new organization which should consider canal matters exclusively, the suggestion mentioned in the preceding paragraph was carried out and a call was issued for a State Commerce Convention. But before going on with this subject we shall see what steps the Governor was taking to solve the canal problem.

On March 8, 1899, Governor Roosevelt appointed a body of seven men to serve on what is known as the Committee on Canals. This has sometimes been called the Governor's Advisory Committee. A month earlier, on February 8, the New York Board of Trade and Transportation had addressed a communication to the Governor and on the same day had adopted resolutions which were sent to him, in each of which it was declared that the time had come for radical measures if New York were to preserve her proper commercial posi-

tion. The resolution went on to recite that New York had not kept pace with the gigantic strides of sister states, the Dominion of Canada or competing ports in the way of improving or enlarging its canals and providing terminal facilities, and that, unless the abuses of railroad discriminations, elevator charges, wharfage exactions, port charges and all other kinds of taxes on commerce were corrected at once and the canals improved without delay, it was certain that New York would soon be compelled to surrender her commercial supremacy to more active and far-sighted competitors. Doubtless these communications helped to influence the Governor in his action.

The Canal Committee consisted of five citizens of New York state, General Francis V. Greene, of New York city, George E. Green, ex-Mayor of Binghamton, John N. Scatcherd and Major Thomas W. Symons, U. S. Engineers Corps, of Buffalo, and Frank S. Witherbee, of Port Henry, and two State officials, Edward A. Bond, State Engineer, and John N. Partridge, Superintendent of Public Works. General Greene and Major Symons were West Point graduates and army engineers of wide experience. Major Symons, as we have seen, had already given the New York State canal question careful study. The other members were men of business who were versed in transportation problems. It is said that ex-Mayor Green represented anti-canal sentiment, being himself opposed to canals when the committee began its investigation, but that he had become a staunch canal advocate by the time the committee's work was finished.

The Governor began his letter of appointment to the several members of this committee by saying, "I am very desirous of seeing the canal policy of the State definitely formulated," and he closed the letter with the words, "The broad question of the proper policy which the State should pursue in canal matters remains unsolved, and I ask you to help me reach the proper solution."

The duty of the committee, therefore, was that of formulating a State canal policy, and, as we shall see later, such proved to be the service it performed. The committee spent nearly a year in making its investigation and during this period there was so much uncertainty as to what the findings would be that little could be done by canal men except to await the report. There was one step, however, which waterway advocates could take, and the preliminary call for a State Commerce Convention, of which mention has already been made, went out in May, 1899. In order to understand how through

this and other agencies the apathy on canal matters throughout the state was gradually turned into new enthusiasm, we must look first at the objects the promoters of this convention hoped to attain, as set forth in the call, and then at the work done by the convention. In the call we read:

"How may commerce and manufactures be increased within the State of New York is the question for the State Commerce Convention to consider. What means may be employed for the advancement of these great primary interests?"

"The first practical step in that direction is to get together. No part of the State but is deeply interested in this question. Every part of the State should be represented.

"The second practical step follows, viz., discussion, the presentation of needs, the statement of propositions, the suggestion of and agreement upon measures for a betterment of conditions.

"The third practical step is to unite the influence of all sections represented to secure from the Legislature the enactment of the measures which may be agreed upon."

The convention met in Utica on October 10 to 12, 1899. There were present delegates from 53 chambers of commerce, boards of trade or other business associations, and four county boards of supervisors; also the mayors of 11 cities and the presidents of 19 villages. Hon. John D. Kernan of Utica was elected permanent chairman. One of the three days was devoted chiefly to canal and canal terminal questions and strong canal resolutions were adopted with but one dissenting vote.

In speaking of this convention, Frank S. Gardner, who was elected as one of its secretaries, says:

"The greatest enthusiasm over the canal question was immediately aroused throughout the State, and as had been anticipated it again became the most prominent State issue. So strongly was the influence felt at once that both of the great political parties were easily induced to place planks in their platforms which endorsed the improvement.

"The resolutions of the conventions as printed in the abstracts of the proceedings expressed the policy and wishes of the commercial interests of the State but they can give no conception of the labor involved in presenting them to the Legislature, in spreading them abroad among the people and in meeting and finally defeating the forces of the opposition. The State Commerce Convention served the purpose for which it was called into existence, to revive

the discussion of the canal improvement question at a time when it appeared to be a lost cause. It not only revived the discussion, but it brought to the support of the canals thousands of the most influential business men and politicians in the State." *

During the summer and fall of 1899 the committee on canals of the New York Produce Exchange held a series of meetings for discussing the canal problem. The result of its deliberations was the adoption of a resolution favoring the construction of a canal of a depth of not less than fourteen feet of water and corresponding width, with a new alignment of canal, if necessary, by canalizing rivers. In October this committee received the State Committee on Canals, at the suggestion of the latter, and expressed its views on the subject of canal enlargement. A little later the Produce Exchange invited the commercial organizations of Greater New York to meet its canal committee for a consultation relative to the State canals. This meeting was held on December 12 and in addition to the commercial organizations the State Committee on Canals was present.

In pursuing its investigations the State Committee on Canals held various public hearings and conferred with interested business men and also sought through correspondence the opinions of many who were qualified to give helpful information or advice. The meetings with the Produce Exchange were in line with this policy. These meetings are chosen for mention here because they are typical of what was taking place and also because this was the most prominent among the organizations or individuals to recommend an enlargement somewhat like the plan which was eventually adopted.

The Committee on Canals carried on its work with zeal throughout the year 1899. One of the members, Mr. Witherbee, visited Europe during the summer and made a study of the canals of France, Belgium and Germany. The Committee called to its assistance distinguished engineers and experts in canal matters and in its report it was able to present a document replete with well-considered and authoritative statements, supplemented by a large collection of valuable information, the statistical tables and data relating to canals and commerce being compiled by the Committee's competent secretary, John A. Fairlie.

For the welfare of the canals a committee such as this proved itself was indispensable. The people of the state had evinced a willingness to make whatever improvement seemed best, but after the failure of the nine-million project they were bewildered and

* *Buffalo Historical Society Publications*, Vol. XIII, pp. 10-11.

distrustful and they needed guidance, and it was necessary that their leaders and advisers should be those in whom they could have implicit confidence. The personnel of the Committee, together with Governor Roosevelt's well-known reputation for straightforward dealing, furnished ground for this confidence and the report when it was rendered gave evidence of being an able, unbiased and authoritative decision.

On January 15, 1900, the Committee on Canals transmitted its report to the Governor. It recommended that the Erie, Oswego and Champlain canals should not be abandoned but should be maintained and enlarged and that the Black River and the Cayuga and Seneca canals should be maintained as navigable feeders but not enlarged at that time; that the project of a ship canal to enable vessels to pass from the Lakes to New York city or beyond without breaking bulk was a proper subject for consideration by the Federal government but not by New York state; that the enlargement of the Oswego and Champlain canals be completed according to the 1895 project, the estimated cost being \$2,642,120; that the State should consider two projects for enlarging the Erie canal, first, to complete the nine-foot deepening of channel but with locks capable of passing boats 125 feet long, 17½ feet wide and of 8 feet draft and 450 tons capacity, one of the double locks to pass a single boat and the other to pass two boats traveling tandem, and with pneumatic or mechanical lift locks at Cohoes and Lockport and new locks at Newark and Little Falls, a new canal by river canalization between Clyde and New London and from Cohoes to Rexford and possibly to Little Falls and a new route from Cohoes falls to the Hudson river, this project being estimated to cost \$21,161,645, or second, to construct a canal along the same route but of sufficient size to carry boats 150 feet long, 25 feet wide and of 10 feet draft and a cargo capacity of 1,000 tons, and with locks about 310 feet long by 28 feet wide, this project, estimated to cost \$58,894,668, being the one recommended; that money for the improvements be raised by 18-year bonds to be paid by taxes levied on counties bordering the canals, the Hudson river and Lake Champlain; for the efficiency of the canals that all restrictions as to the amount of capital of canal transportation companies be removed; that mechanical traction be substituted for draft animals and mechanical power for hand power in lock operation; that the force of canal operatives be organized on a permanent basis; and that unbalanced contract bids be made impossible by a revision of the laws.

The Committee in its report sets forth in considerable detail its reasons for the recommendations it made. In our present study it is not necessary that we should review these discussions. The report is readily available to anyone who desires to examine it. It is important to know, however, that the arguments and the conclusions seem to have been convincing to the public and to have furnished a definite and satisfying policy for the people of the state to adopt. The comprehensiveness of the report tended toward this result. In addition to these discussions it contained the detailed estimates, reports of the engineers, a report on European canals, a study of costs of transportation by various sizes of boats and canals, copies of correspondence, the minutes of hearings and a valuable collection of statistics and canal data.

The report also discusses at some length the two alternative propositions which might have been chosen in place of the one recommended — one, the abandonment of the State canals and the consequent dependence solely on railroads, and the other, the building of a ship canal. These are questions which we must comprehend if we are to perceive the trend of events and know why the people of the state both decided to improve the canals and also determined on the barge canal type of improvement. To show by what reasoning the Committee arrived at its conclusions in these matters a few excerpts have been chosen.

"The question which now confronts us," says the report, "is whether the railroads, with their large capital and scientific management, their durable road beds, powerful locomotives, larger cars, greater train loads, greater speed, and more certainty of delivery, will be able now or in the early future to reduce the cost of transportation below what is possible on the canals. If they can do this, then it is obviously unwise and improper to expend any more public money upon a method of transportation which, however important in the past, would no longer be able to compete with other and improved methods. The determination of this question seems to us to lie at the very foundation of the canal problem, and we have therefore given it the utmost attention."

After considering the facts carefully the Committee concludes, "In our judgment, water transportation is inherently cheaper than rail transportation." In further consideration the report says:

"New York has certain topographical advantages which it would be folly not to utilize. Through the valleys of the Hudson and the Mohawk and the comparatively low and level lands west of Oneida Lake it is possible to construct a water route connecting the Great

Lakes and the Atlantic coast, and no such water route can be constructed through any other state. . . . If the water route is abandoned, then New York must take its chances in the railroad competition with Portland, Boston, Philadelphia, Baltimore, Newport News and Savannah. In this competition it is hardly on an equality even, but is subject to many disadvantages; . . . If the city and State of New York are to take their chances in open railroad competition, then we must inevitably look to see the relative proportion of exports through New York constantly decreasing, as it has been for the last ten years.

"It is evident that the water route via the St. Lawrence on the one hand, and the short rail lines to Gulf ports on the other, will inevitably prove serious competitors in the future to the export trade of New York. If it desires to retain its export grain trade, it must improve its own water route to the utmost limit of which it is capable; it cannot retain this trade by taking its chances in the railroad competition of half a dozen routes from the lakes to the Atlantic.

"It is not alone, however, the export grain trade which requires the enlargement of the Erie canal. . . . But the changes which are now taking place in the iron trade give reason to believe that if an adequate waterway can be secured between Lake Erie and the Hudson river the center of the iron industry can be brought within the state of New York. . . . We believe that a suitable enlargement of the Erie canal at the present time is justified by the prospect of its use in connection with the manufacture of steel and iron and shipbuilding, fully as much as its original construction was justified by the prospect of transporting breadstuffs.

"The possibilities of manufacturing development along the banks of the Niagara river between the Falls and Buffalo should not be overlooked in considering the transportation problem."

Concerning the ship canal project the Committee says:

"It seems to us that there are certain insuperable difficulties in the way of such a canal ever being a success, no matter by whom constructed. It is intended to be used by a vessel which can navigate the ocean, the canal and the lakes. We do not believe that such a vessel can be constructed so as to be economically and commercially successful. The ocean steamer is built to withstand the fierce storms of the Atlantic, and costs in its most modern type about \$71 per net ton of carrying capacity.*

*Report of Major T. W. Symons, in Report of Chief of Engineers U. S. Army for 1897, p. 3174.

"The vessel to navigate the lakes is built to withstand less frequent and dangerous storms; it has less draft, on account of the smaller depth of the harbors on the lakes, and it is built much less substantially; its cost is about \$36 per ton of carrying capacity.†

"The cost of a canal fleet, consisting of a steamer and three consort, with a total cargo capacity of 3,900 tons, according to figures furnished us by boat builders, would be \$28,500, or \$7.31 per ton.

"We have, then, the difference in first cost between \$71, \$36 and \$8 per ton of carrying capacity for the three type of vessels which, in the evolution of business, have been produced as the most economical for the particular class of work each has to do. We do not believe that it is possible to combine these three types into one vessel, which will be as economical for the through trip, as to use the three existing types with two changes of cargo, one at Buffalo and one at New York, or to use the boat of 1,000 tons' capacity going through from the lakes to New York and there transferring its cargo to the ocean steamer."

The Committee gave \$62,000,000 as its estimate of cost for carrying out its recommendations. This is a rounded form of a total of \$61,536,788, made up of \$58,894,668 for enlarging the Erie canal to a size suitable for barges of 1,000 tons capacity, and \$818,120 for the Oswego canal and \$1,824,000 for the Champlain canal, each to be completed to a nine-foot depth along the line of the improvement already begun. The Committee stated that in its opinion the estimates were sufficiently accurate for submitting the proposition to the voters at the next November election, but it advised that in the meantime the Legislature appropriate \$200,000, to be immediately available, so that detailed surveys could be completed during the current year, since such surveys were indispensable, so the Committee said, to the proper making of contracts.

Ten days after the Committee on Canals presented its report, or on January 25, 1900, the New York Commerce Commission submitted to the Governor a voluminous report of about 2,200 pages, together with a book of maps. This is the commission which was appointed by Governor Black in 1898 to inquire into the causes of the decline in New York commerce. The commission had held its hearings not only in New York state but also in the West and in addition

† Ibid, p. 3176. These figures were based on the actual cost of vessels constructed between 1893 and 1896. At the present time, owing to the increased price of steel, the cost of each would be largely increased."

had visited all the important seaports which were business rivals of New York city.

In Governor Roosevelt's message transmitting the Commerce Commission's report we find several paragraphs pertinent to our study. His words are important because they reveal the opinion of a careful thinker, one who characteristically was incisive in reaching the core of things. Moreover he did not let political expediency control his honest convictions and was fearless in voicing his opinion. We shall see that within the next four years one of the sorest trials of canal advocates was the hesitancy of politicians to espouse a cause which they feared might be unpopular with some of their constituency and so might injure their personal prestige. The Governor sent this report and also that of the Committee on Canals to the Legislature on the same day. We quote from his message. If one is at all puzzled to know why the canal problem would not down, even after many rebuffs, as we shall see later, perhaps he may find the reason in the following paragraphs:

"The Canal Committee of which General Greene is the chairman (the report of which I am transmitting at the same time) was appointed solely to consider the canal problem. The Commerce Commission was appointed to consider the whole problem of New York's loss of commerce, inquiring into all the causes, and seeking to find out all possible remedies. It speedily discovered, however, that the question of the canal was really the central question around which hinged all others concerned with benefitting the commercial development of New York or arresting the decline of this development. This is a further proof, if any be needed, of the immense importance of the canal and of the extreme unwisdom of abandoning it as an outworn institution.

"The commission, as of the first importance, recommends action on the State canals themselves. They agree with the committee of which General Greene is chairman that in the first place, the canals cannot be abandoned; that in the second place, a ship canal ought not to be built by the State; and that in the third place, the present canal must be enlarged."

There is another paragraph which we must quote, not because of its bearing on the subject immediately in hand but because it helps us to understand why, after their nine-million-dollar experience, the people were willing to authorize another and vastly larger expenditure. We believe that those who know the facts have come gen-

erally to accept the view expressed here by the Governor. He says:

"I desire especially to call your attention to that portion of the Commerce Commission's report which shows the main source of the trouble over the nine million dollar expenditure for improvements under the Act of 1895. The Commerce Commission's report makes it perfectly clear that there never was sufficient authority, or indeed any authority, for supposing that this nine million dollars would be enough to complete the work, and that a sum was named which was entirely insufficient. It was doubtless believed to be easier to get the small sum than a large one."

There was no mistaking Governor Roosevelt's position on the canal question. New York owes him a debt of gratitude for taking the initial step in solving her problem, just as the nation is beholden to him for the Panama canal. He concluded his message by saying, "Prompt action should be taken to remedy the evils complained of. We cannot afford to rest idle while our commerce is taken away from us, and we must act in the broadest and most liberal and most energetic spirit if we wish to retain the State's commercial supremacy."

The Commerce Commission reported that the decline in New York's commerce had been steady and continuous for many years but more pronounced in recent years and had then reached serious proportions of actual loss; that, while New York had been steadily losing, Montreal, Boston, Baltimore, Newport News, New Orleans and Galveston had made substantial gains; that this loss was due in great measure to a discrimination against New York in railroad rates imposed by an agreement, known as a differential agreement, between trunk line railroads of the Atlantic seaboard, and as a result New York was prevented from receiving the benefit of her natural advantages; that this discrimination would be impossible without the participation of the New York Central Railroad Company and as this company had been the recipient of exceptional benefits from New York State its action was particularly culpable; that the principle of differentials is inequitable and unjust both in theory and in practice and New York had suffered much therefrom and should use every means not only to have it abolished but to render its restoration impracticable; that to abolish the differential would not only result in New York regaining the commerce then diverted to other ports but would also benefit the producers and exporters of the West; that the demand that the New York Central Railroad withdraw irrevocably from the differential agreement was made understandingly;

that the State had it within its power through adequate improvement of its canal not only to prevent further loss of commerce but also to regain that already diverted; that this result could be achieved through completing the nine-foot deepening of the canals at an expenditure not to exceed fifteen million dollars, but to receive the full benefit of this improvement the State should provide canal terminals at Buffalo and New York; and that, while thus providing for competition with rail rates sufficiently to render difficult if not impossible a discrimination against New York, high port charges in New York city should be reduced.

The Commission made eight recommendations for immediate legislative action, as follows: That the canals be completed according to the nine-foot plan without delay, a referendum to authorize fifteen millions for the purpose to be submitted to the people at the next general election; that canal terminal facilities be provided at New York and Buffalo; that the act regulating the fees and charges at elevators be amended so as to make evasion difficult, to fix a maximum rate and to provide a penalty for violation; that the act limiting to fifty thousand dollars the capital stock of corporations carrying on a navigation business on the canals be repealed; that the old provision be restored, reserving the canal piers in New York city exclusively for canal boats; that an act be passed prohibiting the conveyance in perpetuity of any land under water within the limits of New York city, but providing for the lease of such land with power of renewal; that legislative authorization should be given each year to enable New York city to carry out its plans for the construction of piers and the improvement of dock facilities, the city being urged speedily to supply the demands of commerce for modern piers, and the Legislature to aid such endeavors; and that New York city be authorized to acquire possession of the water-front between Gansevoort and Twenty-third streets.

This commission was appointed to investigate conditions which were universally recognized not only as existing but also as being detrimental to the interests of both the city and the State of New York. As was to be expected it found abundant evidence of these conditions and of their detrimental character, but the tenor of its conclusions was anything but despairing; rather a compelling optimism appeared in its vision of what the future would hold if proper precautions were taken. We quote some of its words of confidence, but they are words of admonition as well.

"It is within the power of the State," said the Commission, "to retain not only her commerce of the present; to achieve in the future not only the supremacy of the past; but to excel all former achievements. Her ultimate possibilities can be accomplished only through a comprehensive knowledge of the many divergent interests entering into commerce and transportation, and a systematic attention to commercial requirements, not possible of attainment within a limited period, nor by a temporary commission, nor by local officials with jurisdiction confined alone to either one of the two cities forming the termini of her system of water transportation.

"With a foreign commerce that still approximates one-half of the total foreign commerce of the nation, the part of wisdom would dictate as complete and well considered a method of official supervision as is usual among nations."

CHAPTER IV

THREE YEARS OF BARGE CANAL AGITATION

Effect of Canal Committee's Report—Dinner to Governor—Survey Bill Passed—Route Described—Engineering Force Organized—Second Commerce Convention (1900) Fails to Take Definite Canal Stand—Canal Planks in Party Platforms of 1900—Canal Association of Greater New York Formed—Activities of Canal Bureau of Buffalo Merchants' Exchange—Discussions by Engineers—Report on Preliminary Barge Canal Survey: Routes and Estimates—Governor's Transmitting Message—His Recommendation—Reply by Commerce Convention—Baffling Situation—Compromise Measure Defeated in 1901 Legislature—Law Restricting Capitalization of Transportation Companies Repealed—Steel Canal Boats Withdrawn—Need of Terminals Illustrated—Canal Factions Attempting to Unite—Commerce Convention of 1901 Favors Thousand-Ton Canal—Compromise Measure Suggested at Dinner to Governor—Governor's 1902 Message Proposes Completing Nine-Foot Channel and Building Barge Locks—1902 Legislature Fails to Pass Canal Bill—Legislation Indirectly Affecting Canal Passed—Review of Situation—Public Interested in Other Projects—Canal Planks in 1902 Platforms—Canal Prominent in Political Campaign—Question Saved from Becoming Party Issue—Conference as to Route—Dinner to New York Editors—Drafting Canal Bill—Governor Proposes Lake Ontario Route.

THE presentation of the two reports we have just been considering, especially that of the Committee on Canals, made a deep impression on the people of the state. The advocates of the canal were surprised at the magnitude of the proposal and also pleased at the prospect of obtaining a thoroughly modern and ample canal, more even than they had dared to hope for. From the enemies of the canal on the other hand there came a most determined and bitter opposition. This antagonism first showed itself in the legislative fight on a bill to provide funds for making the survey recommended by the Committee. While the sum asked in this bill was not large and the making of the survey did not of itself commit the State to any canal improvement, the opponents seemed to consider that the passage of the bill meant the beginning of a radical change in the canal policy of the State, which would probably result in an enormous expenditure for a new canal of greatly increased size. Accordingly they fought the measure desperately.

It was in January, 1900, that the report of the Committee on Canals gave to the State a definite canal policy — the desideratum, by the way, which Governor Roosevelt had suggested in his letter of appointment. It was not till April 7, 1903, that the Governor signed the referendum which gave to the people the opportunity of deciding whether the Barge canal should be built. The period between, except for the preliminary survey, was largely one of either legislative battles or of attempts on the part of canal advocates to unite on a single plan of action. It is to this field of activity, then, that we must look for the canal history of these years.

Soon after the presentation of the Canal Committee's report various bills were prepared authorizing canal improvement, but after further consideration and a conference with the Governor these were dropped for the session. It was decided, however, to attempt to secure \$200,000 for making the survey proposed by the Committee. Accordingly a bill for this purpose was introduced in the Assembly by Henry W. Hill, chairman of the Assembly canal committee, on March 6, 1900, and in the Senate by Henry Marshall on March 8. Immediately opposition became manifest in both branches of the Legislature. The situation was still further complicated by the introduction in the Assembly on March 7 of a resolution proposing to amend the Constitution so as to enable the State to transfer its canals to the Federal government. The press took up the fight and was divided in sentiment.

But before following further the fate of this bill let us look for a moment at the dinner tendered Governor Roosevelt by the leading commercial organizations of the city of New York. It was held at the Waldorf on March 10, 1900, and besides the Governor there were present as guests of honor the members of the Committee on Canals and the Commerce Commission. The dinner was given in recognition of the Governor's friendly attitude toward canal interests and also in appreciation of the services rendered to the State by the two committees. It was reported that 460 prominent business men of the city and the state were present and that they represented nearly all the commercial bodies of the city.

This gathering was important because it helped to bring into a united body of canal advocates the large number of influential men in attendance and also because it stimulated wide-spread interest in the proposed canal improvements. It is said that it decided the fate of the survey bill then pending in the Legislature.

The occasion was important too because of certain things that were said. The Governor in his remarks showed himself in favor of a suitable canal improvement and pointed out the need of keeping several vital features in view. He declared that the proposed scheme was the only one that offered an adequate check on the railroads which then did or which could show their mastery over commerce, but he warned that the very vastness of the scheme demanded the most careful preparation, in order not to repeat the mistakes of former efforts. He counseled thorough and ardent missionary work to make the people of the state feel the necessity of doing what was proposed; also the need of keeping steadily in mind the all-important fact that the canal is not an outworn method of transportation, experience having proved that during the lifetime of the present generation every great European country in which topographic conditions permitted the existence of canals had developed its canal system to a greater extent than its railroad system. He urged the elimination of party division, since the questions involved were purely economic, and he declared that the only chance of building the canal so that the State would receive a dollar's worth of gain for every dollar expended lay in building it on strictly business principles and not allowing it to become the football of partisan, factional or personal politics—those who should build and administer it doing their duty solely as administrators and engineers and not as politicians.

Returning to the survey bill we find that its passage through the Legislature was most stormy. It is said that probably no bill was ever fought more bitterly. It will be interesting and instructive, therefore, to follow this battle. The usual hearings were supplemented by a flood of letters, resolutions, petitions and memorials from various parts of the state, but still the bill was not reported out of committee and it seemed for a time that it was dead. In the closing days of the session a last and apparently a forlorn effort to pass the measure was made.

The Senate Finance committee by a vote of six to six had refused to report the bill, but Senator Ellsworth, chairman of the Rules committee, reported a rule which brought it out and on the day before adjournment under his able leadership, supported by Senator Grady, it was pushed through to successful passage.

When the bill reached the Assembly it was referred to the Rules committee, which was opposed to canal improvement and already had under consideration the similar bill introduced by Assemblyman



Part of Waterford series of locks—the most remarkable series in the world—consisting of five locks having an aggregate lift of 169 feet, situated within a length of channel of $1\frac{1}{4}$ miles. View of three locks of the series. Wide pools between the locks; by-passes around them.



Hill. The canal vote in the Assembly was not sufficient to discharge the committee from further consideration of the bill, but during the night preceding and the morning of adjournment the committee was deluged with letters and telegrams. The Speaker stood with the opposition on this matter and refused to let the bill come before the Assembly. It was only by various organizations working through United States Senator Thomas C. Platt that sufficient pressure was brought to bear to have the bill reported. After the clock had been turned back the Rules committee finally reported the bill and it was passed.

The action of these closing days had been most dramatic. The fight in the Assembly is said to have been one of the most strenuous ever witnessed in that body. To Henry W. Hill is due much of the credit for the victory. If this legislative battle was one of the bitterest ever fought in the state, then the measure itself, so canal men think, because of its far-reaching influence, was one of the most important to the State ever enacted.

With the signature of the Governor on April 12 the act became chapter 411 of the laws of 1900. It directed the State Engineer to make the necessary surveys and estimates for constructing and improving the Erie, Champlain and Oswego canals substantially in accordance with the recommendations of the Committee on Canals. By specific requirement all surveys, plans and estimates were to be made with the same accuracy and as much care as if the work of construction had actually been ordered. All was to be done in time to report to the Legislature at the beginning of the 1901 session.

The improvement contemplated for the Oswego canal was in effect the completion of the nine-foot deepening, while for the Champlain canal the plans were to provide for a depth of seven feet of water.

In planning the Erie canal provision was to be made for the passage of boats 150 feet long, 25 feet wide and of 10 feet draft, with a cargo capacity of approximately 1,000 tons. The minimum dimensions of prism were to be 75 feet bottom width, 1,125 square feet sectional area and 12 feet depth of water except at structures, where it might be lessened to 11 feet. The locks were to be not less than 310 feet long in the clear, 28 feet wide, with 11 feet of water over the sills and a capacity for passing at one lockage two boats of the size mentioned in the act.

Inasmuch as the route of the prescribed surveys differed in many places from the line of the existing canal, it is well to examine its course with some care, especially since the canal as it was eventually

built follows in general this new route. In the western part of the state the existing line was to be used except at certain specified places. These changes included a short section of new canal at Medina and the elimination of two bends near South Greece. At Rochester three routes were to be surveyed — through the city along the existing canal, to the north of the city and to the south of the city. At Brighton, Macedon, Newark and Lyons short changes of alignment and the elimination or combining of locks were to be made. Easterly from Clyde the survey was to leave the existing canal and follow the valley of Crusoe creek and then proceed through Seneca river, Oneida river and Oneida lake and up the valley of Wood creek to New London, where the existing canal line was again encountered. This was a divergence differing in some places by a distance of about fourteen miles from the line of the existing canal. A spur was to reach Syracuse through Onondaga lake. Between Rome and Cohoes estimates were to be made for enlarging the existing canal and also for canalizing the Mohawk river. Also certain modifications and details were specified at Utica, Fort Herkimer, Little Falls and Schoharie creek and between Cohoes and the Hudson river and for locks at Cohoes falls, Newark and Lockport.

The task laid out by this law was exceedingly large and the time for accomplishing it was short. State Engineer Edward A. Bond lost no time, therefore, in organizing a corps of engineers to undertake the work. In fact the first steps were taken on April 8, two days after the bill was passed and four days before it was signed. By the first of May parties were in the field, the engineers to have charge of various divisions of the work having been appointed and instructions for survey parties having been prepared and passed upon by a special board of engineers prior to that time.

Mr. Bond is to be highly commended for the type of engineers he secured and for the quality and thoroughness of all the work done. He was fortunate too in the selection of his advisory engineers and also of certain experts in special features. What he said concerning this survey in his current annual report shows that he appreciated the importance of carrying out the mandate of the Legislature in a manner that would be beyond criticism or reproach. To quote his words:

"The report upon this survey will be exhaustive, and will include the results of studies by specialists in all the different features involved in the design of a modern canal; it being the intention of the State Engineer that the plans for this work shall be so thoroughly

considered and that the estimates of cost for its various portions shall be agreed upon by so many well-known and experienced engineers . . . that they shall command the confidence of the public and will enable the Legislature and the people of the State to form a full and unbiased judgment as to the desirability of building this great canal." *

Mr. Bond appointed as consulting engineers Trevor C. Leutzé, of Albany (division engineer of the eastern division of his department), and David J. Howell, of Washington, D. C., who had had charge of work on the eastern division of the Mohawk and Oswego line of the Deep Waterways Survey, with Mr. Howell acting as engineer in charge of the survey about to be undertaken. William B. Landreth was assigned to the position of special resident engineer in charge of the middle division and James J. Overn to that of special resident engineer in charge of the western division, while to John R. Kaley, assistant engineer, (at one time division engineer of the eastern division of the State canals) was assigned the task of preparing from notes acquired through previous improvements the estimates for the Champlain canal.

The instructions for survey parties were submitted to a board of engineers consisting of George S. Greene, of New York city, Past President of the American Society of Civil Engineers, George Y. Wisner, of Detroit, Mich., Edward P. North, of New York city, Professor Palmer C. Ricketts, of Rensselaer Polytechnic Institute, Troy, N. Y., and J. Nelson Tubbs, of Rochester, N. Y.

The questions concerning high lift locks were submitted to a board of advisory engineers and this board included Elnathan Sweet, ex-State Engineer, chairman, George S. Morrison, a member of the Isthmian Canal Commission and Past President of the American Society of Civil Engineers, Major Thomas W. Symons, Corps of Engineers, U. S. Army, a member of the New York State Committee on Canals, William H. Burr, a member of the Isthmian Canal Commission and a professor in Columbia University, and Major Dan C. Kingman, Corps of Engineers, U. S. Army.

After this board had made its report on the high lift locks, the members with one exception were retained as a general advisory board. Major Kingman, who was stationed at Chattanooga, Tenn., and could not conveniently continue as a member because of the long travel required, tendered his resignation and Alfred Noble, of Chicago, a member of the Isthmian Canal Commission and also

* Report of State Engineer for 1900, p. 11.

one of the three engineers comprising the Board of Engineers on U. S. Deep Waterways, was added as a new member.

Other engineers to fill important positions were Emil Kuichling, who made the investigations for water-supply, James H. Brace, who had supervision of office work, A. E. Broenniman, an expert computer, who had charge of estimates along the existing canal from Rexford to the Herkimer-Oneida county line, J. T. N. Hoyt, who estimated the bridges, S. J. Chapleau, who estimated the locks, and Chauncey N. Dutton and William R. Davis, who submitted plans for locks of high mechanical lift.

The field work of the United States Deep Waterways survey had preceded this preliminary Barge canal survey by only two or three years and several of the engineers who had been engaged on the former project were available for the new survey. Both enterprises involved the same kinds of work and the men fresh from the first were especially fitted to undertake the second with despatch and vigor. The field work was pushed so rapidly that by September 8 it had been finished on the middle division and by the latter part of the same month on the western division. The office work of making maps from the field notes had been carried along continuously with the surveys and by October 1 the middle division office was closed and a week later the western division office and such men as were suitable were transferred to the office of the consulting engineers at Albany, where the work of making plans and computations was carried on to completion. By the courtesy of the Deep Waterways Board photographic copies of the maps prepared from the earlier surveys were made available and these aided materially in the new work, many miles of surveys and mapping being saved thereby.

While the engineers were busy doing their part, canal advocates were not idle. The success of their efforts in the legislative strife gave new life to their enthusiasm. The opponents of the canal were also very active, all over the state. Through their grange organization the farmers were bitterly fighting all canal improvement. The railroads were doing everything they could, both openly and secretly, to defeat the project. One railroad emissary was especially prominent during the years between the failure of the nine-million scheme and the early stages of Barge canal construction. This was John I. Platt of Poughkeepsie. But he fought in the open, often was a delegate to the canal and commerce conventions and sometimes was invited to address these conventions and express his views in opposition.

The second annual State Commerce Convention met in Syracuse on June 6 and 7, 1900. A larger number of delegates attended than were present at the convention of the year before at Utica and it is said that the feature of the convention was the unanimity of sentiment in favor of canal improvement. There was a pronounced division of opinion, however, as to what that improvement should be.

The State Committee on Canals, it will be recalled, had placed two projects before the people—one a modification of the nine-foot deepening and the other a 1,000-ton barge canal. The Committee had come out boldly and in most decided terms had recommended the latter scheme, but it was evident at the Commerce Convention that the majority of delegates lacked the courage to take an equally bold stand. Or perhaps it was faith that they lacked, the faith to believe that the people of the state were ready to solve their transportation problem by building an adequate rather than a make-shift canal, and so they were going to be satisfied with a half loaf, lest otherwise they might get nothing.

The New York city delegates at this convention stood almost alone in their advocacy of the larger plan and in the end they were beaten. It is true, as one member of the committee on resolutions has said, that the most serious problem before the convention was the form of endorsement which should be given to the canal project, and also that it was a delicate matter to decide in advance of the surveys then being made what action was wise, but in the light of subsequent events it seems probable that the building of the Barge canal was delayed one and possibly two years by the failure, not of this convention alone—it merely reflected a prevailing sentiment—but of canal and political leaders generally to appreciate what the situation demanded and then to act upon their conviction.

The convention adjourned to meet again after the State Engineer should make his report to the Legislature. The canal resolution it adopted was simply a spineless declaration "that the future prosperity of the entire State requires the improvement and enlargement of its canals in a manner commensurate with the demands of commerce and to a capacity sufficient to compete with all rival routes."

The convention proved effective, however, in giving publicity to the canal question and in keeping it a live issue in the state. The delegates from interior towns carried back with them to their several localities new interest in canal affairs. Also this conven-

tion appointed a committee to appear before both the Republican and the Democratic State conventions and urge the insertion in their respective platforms of a plank favoring canal improvement.

There was another organization which helped to secure canal planks in the party platforms of 1900. A delegation from the canal committee of the New York Produce Exchange called upon the political leaders to urge the importance of their views. Both parties heeded these appeals and adopted canal planks. The Republican plank was constructive in standing for a full study of the canal problem. The Democratic plank denounced Republican canal administration and pledged support for the canals, but only in general terms.

During 1900 there was formed a most important canal organization, the Canal Association of Greater New York, representatives of ten of the leading commercial organizations of New York city being present at the initial meeting and nearly an equal number of organizations joining later. Organized for the purpose of forwarding canal interests, it did valiant service in the next three years — a most critical period in State canal history. By means of public meetings, press articles and the distribution of literature it carried on a lively and persistent agitation for canal improvement. After the election in the fall of 1900 a committee from this association called upon Governor-elect Odell and laid before him their views on the subject of improving and enlarging the State canals.

In the canal agitation which has been going on since 1884 — the year from which the present era of consecutive improvements may be dated — the centers of aggressive activity have been New York city and Buffalo. We have seen something of what New York was doing in 1900, but Buffalo also was busy.

A committee was appointed by the Buffalo Merchants' Exchange to undertake a systematic and thorough campaign of education. Under this committee there was organized what was known as the Canal Bureau of the Merchants' Exchange, with George Clinton as chairman, George H. Raymond as secretary and Howard J. Smith as assistant secretary. The credit for raising the funds to finance this bureau, which continued its work from 1900 to November, 1903, is due chiefly to Alfred Haines, President of the Exchange. To prepare the way for proposed legislation at the 1901 session a dozen stenographers and other office force were employed and they were engaged largely in sending out to all parts of the state an enormous number of letters, circulars and printed matter. Also newspapers were furnished with articles and especial attention

was given to country newspapers, about 200 country weeklies being supplied with "plate." Moreover meetings were arranged and speakers were sent to address them, and this form of campaign was extended particularly into anti-canal localities. The object of all this was to make it possible for the people of the state to have a thorough understanding of what the 1,000-ton barge canal really meant to them, how the commercial interests would be affected by it and how even the farmer and the inhabitants of the counties at a distance from the canal would be benefitted.

All of this publicity on the part of canal advocates naturally resulted in discussions which brought out both sides of the question. We find numerous canal articles in the technical and popular periodicals of this year, 1900, and also of the next few years. As an evidence of the interest the subject awakened among professional men of high standing it may be said that in the October, November and December, 1900, and the February, 1901, proceedings of the American Society of Civil Engineers appear papers and their subsequent discussions on canal topics. One, entitled "Canals between the Lakes and New York," was presented by Joseph Mayer, and another, "Economic Dimensions for a Waterway from the Great Lakes to the Atlantic," was presented by George Y. Wisner.

In his annual message to the Legislature of 1901, at the beginning of his administration, Governor Odell did not give the slightest hint of his attitude on canals, merely stating that he would defer making any recommendations until the forthcoming report should be received.

This report, the result of the survey for the proposed 1,000-ton barge canal, was presented to the Governor by the State Engineer on February 12, 1901. The Governor in turn transmitted it to the Legislature on the 15th day of the following month. Together with this report was another which the State Engineer had prepared at the request of the Governor and which contained estimates of cost for completing the improvements begun under the law of 1895, the act which authorized the expenditure of nine million dollars in deepening the canals. In his message accompanying these reports the Governor plainly showed his opposition to the barge canal project and proposed instead the completion of the partially finished deepening.

But before considering the Governor's message we shall look for a little while at the State Engineer's report of his survey — the report of the preliminary Barge canal survey, as it has now come to

be known. In its printed form this report consisted of a volume of 1020 pages and an atlas supplement containing 35 plates of maps, profiles, plans and diagrams. Considered from an engineering standpoint this report left little to be desired, and requests for copies of it, coming from engineers who wish to use its valuable data in the design of other projects, has continued down to the present day, although the edition was exhausted very soon after its publication. In addition to the descriptions and estimates in detail of the various routes and the many alternate portions of routes, the volume contains the reports of the State Engineer, the Consulting Engineers, the Board of Engineers on high lift locks and the Engineer on a mechanical lift lock, also a study on tractive resistance to be overcome in navigating the restricted channel of a canal, a copy of the instructions for survey parties and the report of the Engineer for Water Supply, the latter occupying 350 pages and containing especially valuable information.

In reporting on the cost of the proposed 1,000-ton canal the State Engineer gave four sets of figures and these represented the estimates on an equal number of possible routes. At certain places several alternate surveys had been made, so as to determine the best location, but these minor selections had been made by the engineers and only the four main lines appear in the summary of costs. These four routes for the Erie canal are denominated in the report as lines A, B, C and D.

Line A was in general a canalization of natural waterways as far west as Clyde (the Mohawk river, Wood creek, Oneida lake, Oneida river and Seneca river being utilized) and an enlargement of the existing canal from Clyde westward to Buffalo except a detour south of Rochester. This brief description, however, does not take account of the many places where the proposed line entered and left the stream channels and the existing canal, or where bends were cut across or other deviations made.

Line B coincided with line A from the Hudson river to Three River Point, the hamlet at the confluence of Oneida and Seneca rivers. Thence it followed Oswego river to Lake Ontario. Leaving the lake at Olcott it rejoined line A a little west of Lockport and coincided with it again for the remainder of the route.

Line C was the same as line B except that Lake Ontario was utilized to the mouth of Niagara river and lower Niagara river was followed to Lewiston and the upper river from LaSalle to Black Rock with a new canal between Lewiston and LaSalle. According to the law authorizing the survey the Oswego canal was

to be improved only to the extent of completing the nine-foot deepening, but in making it a part of a possible new Erie, or main line, canal it was necessary to plan for a 12-foot channel. As a result two estimates were made for the Oswego canal, one for a nine-foot and the other for a twelve-foot depth.

Two estimates were made for the Champlain canal also, but these were for two choices of route, one the canalization of the Hudson river and the other the improvement of the existing canal, which was almost entirely an independent, or land line channel.

Line D was generally an enlargement of the existing Erie canal. Aside from the portion between New London (a few miles west of Rome) and Clyde, where it coincided with line A, the deviations in alignment from the existing canal, though numerous, were not long.

Line A (Erie canal) was estimated to cost \$72,264,826. With \$1,481,012 for the nine-foot Oswego branch and \$4,750,608 for the Champlain by way of the Hudson, the total for construction by this route was \$78,496,446. From this might be deducted the estimated value of abandoned canal lands, \$1,941,380 on the Erie and \$22,620 on the Champlain, leaving a net total of \$76,532,446 for line A. The distance between Troy and Buffalo by this route was 342.66 miles.

The estimate by line B between Troy and Buffalo was \$46,765,755, exclusive of the Oswego canal. Adding \$5,170,129 for the Oswego branch, which by line B became a part of the Erie canal and had to be 12 feet deep, and \$4,750,608 for the Champlain (canalized Hudson), the total became \$56,686,492. The land values to be deducted were, Erie, \$1,953,202, Oswego, \$2,391, Champlain, \$22,620, making the net total \$54,708,279. By line B the distance between Troy and Buffalo was 338.66 miles.

The estimate for line C differed from that of line B only in the cost of the Erie canal, which was \$48,984,220. This made the total for construction \$58,904,957 and the net total \$56,926,744. From Troy to Buffalo by line C was 347.57 miles.

By line D the Erie canal would cost \$81,578,854. The nine-foot Oswego would add \$1,481,012 and the Champlain improvement of the existing canal \$5,787,929, totaling \$88,847,795 for construction. Deducting \$1,530,225 for abandoned Erie canal lands, there being none to abandon on the Oswego and Champlain branches under this plan, the net total became \$87,317,570. This line gave a distance of 347.66 miles between Troy and Buffalo.

In all of these estimates it was assumed that the Federal government would improve the Hudson river from Troy to Waterford, estimated to cost \$737,683, and the Niagara river from Black Rock harbor to Buffalo, estimated at \$538,051. Without this Federal aid the sum of these two amounts, \$1,275,734, was to be added to all totals.

In estimating the amount of work to be done there was used a minimum land line section of 75 feet bottom width with 12 feet depth of water and slopes to give 123 feet width at water-surface. In rock cutting the channel was 94 feet wide at bottom and the sides nearly vertical. The river channels, in both earth and rock excavation, were 200 feet wide at the bottom. The locks were planned with a length of 328 feet between quoins, a width of 28 feet and a depth of 11 feet of water over the bottom at the ends. The chambers of the locks, however, had curved floors, which were 11 feet below water-surface at the side wall intersections and 18 inches deeper at the center. In locks of over 8 feet lift culverts for filling and emptying the locks were provided in the side walls. From these culverts there extended smaller branches, or ports, which entered the lock chamber at the bottom of the side walls.

These details are all of considerable interest and also rather important, since they explain why certain dimensions or particular types of construction were later incorporated in the law or adopted in the contract plans. An innovation in one certain kind of material is noteworthy. Up to this time, on State work at least, but few sizable masonry structures had been composed of concrete. In the new lock plans the only cut stone was at the hollow quoins and in the face of the lift, or breast, wall at the head of the chamber. The report left the subject of dams in a somewhat uncertain state. In general concrete dams were to be built where rock foundation was encountered and timber dams where gravel or other kindred material was found, but definite plans were not drawn, although the estimated cost was placed at a sum ample for whatever type later experience might dictate. Movable dams were discussed by the Advisory Board but no decision reached.

The Governor's message transmitting the report on the Barge canal survey must have been a bitter disappointment to advanced canal advocates. Not only did he oppose the project recommended so heartily by the Committee on Canals, but he even went a step back of the smaller scheme presented by this Committee, and this smaller scheme had been submitted by the Committee not to endorse

it but simply as a possible subject for consideration. What the Governor did was to recommend the completion of the nine-foot deepening, and that too with provision for boats only 98 feet long, 17½ feet wide, of 7 or 7½ feet draft, and of 315 to 340 tons capacity. The plan for the nine-foot deepening presented by the Canal Committee, it will be recalled, carried with it a lock modification to enable two boats, each 125 feet in length, 17½ feet in width and 8 feet in draft, with a cargo capacity of 450 tons, to travel tandem and be locked at a single lockage without uncoupling. What the Committee said in regard to this their smaller proposition, even back of which the Governor was going, is pertinent here.

"In our judgment," says the Committee's report, "arrived at after long consideration, and with some reluctance, the State should undertake the larger project (1,000-ton canal) on the ground that the smaller one is at best a temporary make-shift, and that the larger project will permanently secure the commercial supremacy of New York, and that this can be assured by no other means." And again: "We believe it is unwise to spend large sums of money in a mere betterment of the existing canal; what the present situation requires is a radical change."

The State Engineer's estimate for completing the canals according to the 1895 plan, as reported by the Governor, was \$19,797,828, the amount for the Erie being \$14,973,323, that for the Oswego, \$2,135,388, and that for the Champlain, \$2,689,117. The Governor suggested that it might be possible, by lock-lengthening and similar changes, to use larger boats and secure more expeditious locking, evidently referring to the smaller project submitted by the Canal Committee. In this case several millions more should be added to the estimate.

In his message the Governor put the canal problem before the Legislature in the form of a three-fold question — "First, shall the canals be abandoned? Second, shall they be enlarged so as to permit the passage of 1,000-ton barges? Third, shall the improvement begun under the act of 1895 be continued along the line of the route of both the Erie canal and its feeders?"

Neither the people of the state nor the Legislature had as yet, of course, given a categorical answer to these questions, but the people a few years earlier had twice expressed their desire for improvement rather than abandonment. And now, if nothing beyond the scheme of 1895 was to be undertaken, the years of investigating and waiting, the elaborate surveys and plans of Federal and State

governments, the herculean struggle and brilliant victory of canal legislators in the preceding session had all been in vain.

The Governor argued the subject at considerable length, evidently to his own satisfaction, and arrived at two conclusions: That the advantages to be derived from a 1,000-ton canal were not commensurate with the expense; and that the purposes for which the canals should be maintained were more for protection against unfair rate discrimination than for actual use. In reading the message, however, one is inclined to think that the latter conclusion was not really a conclusion with the Governor but rather was a premise which molded, unconsciously perhaps, his whole reasoning. If that was his idea of the chief value of the canals, and we fear that it has been for years an all too prevalent idea throughout the state at large, then his search after the cheapest way to retain the canals for any degree of service was at least consistent and can be understood.

The Governor said, moreover, that there seemed to be no excuse for the Legislature to delay in submitting the matter to the people, since a large proportion of the citizens evidently desired positive action. In his closing words he summed up the situation as he saw it. We quote him:

"I therefore recommend that the question of improving the canals along the line of the act of 1895 be submitted to the people at the coming election, in the belief that it will meet with greater approval, that the expenditure can be more easily met, and that it will serve all the purposes for which the canal was originally designed."

This recommendation, of course, immediately aroused the canal advocates. On the day after its presentation a meeting of the canal committee of the Buffalo Merchants' Exchange, at which there was manifested decided opposition to the Governor's plan, appointed a committee to meet with canal friends from other cities and map out a course of action. This conference was held in Albany on March 20 and representatives were present from New York, Catskill, Utica, Oswego and Buffalo.

On March 26 the adjourned meeting of the State Commerce Convention met in Syracuse. This meeting is described as being even more enthusiastic than the two previous conventions and as showing conclusively from the attitude of the delegates that the fight for adequate canal improvement was now fairly on and that no compromise or defeat would be permitted. It is said, however, that serious differences of opinion were still present, as at the convention

of the summer before, and that the Buffalo delegates tried to prevent a declaration for a 1,000-ton canal.

We have looked with some care at the message the Governor sent to the Legislature in presenting the report of the canal survey. The resolutions of the Syracuse convention demand equally careful attention, since they are in effect a partial answer to the Governor's arguments and also they show how irreconcilably opposed to the Governor were these representatives of the commercial interests from various parts of the state.

The resolutions declared that the State canal system was the first great factor in the growth of the state, that it had been the chief means of building up the greatest line of prosperous cities and villages found anywhere on the continent, that it made New York one of the greatest seaports and Buffalo one of the greatest lake ports, and that this growth had brought signal benefits to all classes, the laborer, the farmer and the merchant, in all lines of commercial industry.

These were statements calculated to controvert the Governor's conclusion that the chief function of the canal was regulative. Then the resolution takes up and emphasizes this view of the Governor, but intimates that it is not the most eminent service of the canal, saying that "in addition to its direct influence upon the prosperity of the State" the canal had been such a factor in controlling freight rates that nowhere else on the continent were rates of transportation by both rail and water so moderate as in New York.

Because of its bold challenge the remainder of the resolution should be quoted verbatim. "The condition of the canal system of the State," it says, "is most critical. The present and future commercial prosperity of the State is in great danger. Adequate improvement of the canals must be undertaken. Largely increased facilities for water transportation must be secured if the State's commercial supremacy is to be maintained; therefore,

"Resolved, That it is the sense of this convention that the commercial interests of the State will be best fostered, promoted and protected by the construction of the one thousand ton barge canal."

The convention also sent a committee to confer with the Governor. They called on him on March 29, but their appeal was in vain. He stood squarely for the improvement he had recommended and was not disposed to accept anything looking toward the 1,000-ton canal.

Probably at no time during the history of the Barge canal project have conditions been so peculiar as they were at this juncture. The Governor was obdurate. In disregard of the emphatic recommenda-

tions of a body of expert investigators, who had been chosen because of their ability to render an unbiased and sound verdict, he stood firmly for an improvement which had been first proposed a generation before and was generally considered obsolete. The dominant political party feared to endorse the obviously adequate plan because of the opposition of much of its constituency and at the same time was reluctant to accept the Governor's proposition and thereby displease New York city. The minority party was in almost the same predicament. Canal forces were divided and so wide apart were they that we find the radicals lined up with the enemies of the canals in legislative contests. The only happy individuals were the canal opponents. Not for a decade had the prospect been so bright for defeating all canal improvement in the state.

After numerous conferences the canal men from Buffalo and from "up state" and a part of those from New York decided to make a fight for what they thought there might be some possibility of getting. This was a compromise measure — practically the smaller proposition presented by the State Committee on Canals, except that the Oswego canal was to have as large locks as the Erie. It was a completion of the nine-foot deepening but with lock modifications which would increase boat capacities to 450 tons. A bill authorizing this improvement and carrying an appropriation of \$26,000,000 was introduced in both branches of the Legislature.

This bill brought protests from various organizations, among them the State Grange, the State Farmers' Congress and the State Tax and Transfer Tax Reform Association. The protest from the Canal Association of Greater New York, however, calls for our special attention, because it was this wing of the canal forces, aligned with the enemies, that decided the fate of the bill then pending and eventually also the ultimate fate of the whole canal problem. This association, moreover, exerted a political power that had to be reckoned with.

On April 8 this association adopted resolutions unequivocally declaring its belief that the 1,000-ton canal was the minimum of improvement that should be undertaken and that the expenditure of public funds for any lesser project was unwise. The framers of the resolutions state that they would be stultifying themselves in accepting or recommending acceptance of any improvement that failed to meet the requirements, and that they were asserting their beliefs, not in a spirit of capricious or unreasonable criticism but in full consciousness that the gravity of the situation demanded a larger

rather than a smaller development, and that it was their duty not only to themselves but to those whom they represented to make their position known to the Governor, the members of the Legislature, the commercial bodies throughout the state and the public at large.

Seventeen of the most influential commercial organizations of New York city joined in signing these resolutions. As a further act they directed the chairman of the meeting to telegraph the senators and assemblymen from Greater New York, urging them to vote against the pending canal bill.

Incorporated in these resolutions were two excerpts from the report of the State Committee on Canals. We have already quoted one of these passages. The other is worth noticing and we quote further. The policy here enunciated is the one for which the New York city advocates were standing firm, even with the certainty of delay and at the risk of losing all. But it is the policy which prevailed finally. In the end all friends of the canal conceded that New York city's insistence on a 1,000-ton canal was wise. While the fight was on it was another matter.

"We confine ourselves," say the members of the State Canal Committee, "solely to advising you what in our judgment is the proper policy for the State to pursue in regard to its canals, leaving to those on whom the responsibility rests to decide whether these views should be carried into effect. We feel confident that on mature reflection the Legislature and people of the State will ultimately adopt these views. We have hesitated to recommend the expenditure of a sum of money which, although small in proportion to the resources of the State, is still a very great sum; but after much deliberation we are unwilling to recommend any temporary or partial settlement of the canal question. We do not believe that the adoption of the smaller plan will result in *permanent* benefit to the State of New York, and as the money expended on the smaller project would be almost entirely wasted in case a larger project should be determined upon later on, we do not feel justified in recommending the expenditure of so large a sum as \$21,000,000 for a temporary purpose."

With canal forces divided and a part of them even siding with the anti-canal faction and with the opponents making the most of their opportunity, there could be but one result. The fight was kept up for a time, a hearing being held and the bill being reported out of committees and reaching the stage of third reading in the Senate and

second reading in the Assembly, but when the Tammany assemblymen withdrew their support the fate of the measure was sealed.

After a long conference of the Republican legislators in the Executive Chamber it was finally decided to recommit the bill with instructions to strike out the enacting clause.

Something which one of the senators said at this conference deserves a wide publicity and we quote it here. It was Senator George E. Green who was speaking and what he said may help us to understand why certain localities, even those which might be expected to have pro-canal proclivities, have so persistently opposed various canal improvements. It will be recalled that Senator Green was a member of the State Canal Committee and that he is said to have entered on his work with this Committee an anti-canal man. In the speech just referred to he said: "I come from an anti-canal Senate district. I want to say that we legislators are to blame for this anti-canal sentiment. We go around our districts inveighing against the canals for political effect and our statements have their effect upon the people. Hereafter let us go about telling the way canals will improve the commerce of the entire State. The people will get an improved canal some time. I hope before next year's session of this body that the divided canal interests of this State will come together on the canal improvement question."

Undoubtedly Senator Green gave expression to an important truth. If we could trace community sentiment to its ultimate source we should probably find that in many cases some one individual or a small group of individuals through newspapers or public speaking have been able to mold the minds of their fellows to their own way of thinking.

There was one measure that was passed by the Legislature of 1901, however, which was along the line of advancement in canal affairs. It carried out one of the recommendations made by the State Committee on Canals. And the State Commerce Commission had also made the same recommendation. This was an amendment of the law governing transportation corporations and it removed the restriction which had limited to \$50,000 the capital stock of companies carrying on a transportation business on the State canals.

Just why this limitation had been imposed is not fully evident. On its face it was for the benefit of the boatman of small means who owned one or two or possibly three or four boats. The rapidity with which great corporations were gaining control of elevators and other terminal facilities and the large diversion of traffic from the

canals because of excessive terminal charges, and the connections of these navigation companies with other and competing transportation lines had threatened the existence of the small boatman. To correct this condition the general law governing transportation corporations was amended in 1896 so as to apply to canals and other waterways and the stock of companies navigating the canals was limited to \$50,000, while the minimum was lowered to \$5,000 in place of the \$20,000 minimum in force before. There is some reason to believe, however, that the good of the small boat owner was not the only motive back of this amendment. At all events it did not seem to work out greatly to his benefit and it surely prevented the formation of companies large enough either to command the coöperation of connecting transportation lines or to carry on their business affairs according to modern methods. This break in the chain of transportation, where the small boatman had to be dealt with individually, doubtless accounts for much of the non-use of the all-water route by Great Lakes shippers.

The amendment of 1901, while it eliminated the \$50,000 restriction, sought to retain protection against abuses by adding the clause, "No railroad corporation shall have, own or hold any stock in any such corporation."

Before we return to legislative matters or to the affairs which were interesting canal advocates so deeply at this time, we may notice an occurrence which had to do with practical navigation on the canal. In his report for 1901 the Superintendent of Public Works stated that the three fleets comprising eighteen steel canal boats, which had been operating successfully for a few years and which had been heralded with such acclaims of hope when they had been put in service, had been withdrawn from the canal and sent to the Philippines. These boats had been built by the Cleveland Steel Canal Boat Company and were an innovation in canal boat construction. They made possible and also profitable the establishing of a through line of transportation between Cleveland and New York, since insurance companies would insure these steel boats on the lakes, a risk they had never taken on the wooden boats navigating the canal.

The trial trip of the first fleet — one steamer and five consorts — was made in August, 1895. It was so successful that other boats were added to the service during the next year. They made the trip from Cleveland to New York in from ten to twelve days and their ability to withstand heavy gales on Lake Erie was encouraging. At that time the owners expressed their belief that the boats could com-

pete successfully with the railroads as they then existed at a fair margin of profit. When the boats were withdrawn from the canal the owners admitted that they had made money but there was opportunity for greater profit in their new venture. Their further statement forms an interesting commentary on the report which the State Commerce Commission had made to the Legislature in the preceding year. They said that their canal profits were meager because of the lack of terminal facilities at Buffalo and New York and they added that the decline in rates could be met by boats if it were possible to secure dispatch in handling cargoes but that the canal was destined to be a failure without such facilities.

In all the agitation for canal improvement up to this time and even until several years after the new canal had been under construction, little if any attempt had been made to show the need or to advance the claims of terminal facilities, without which, as these boat owners said, any canal would be a failure. From our present standpoint this omission seems strange. It is generally conceded now that, lacking terminals and freight-handling devices, the Barge canal was predoomed to failure. Perhaps the agitators did not then appreciate the absolute necessity of terminals, and on the other hand perhaps they did not want to complicate the canal problem until the new channel itself was well on its way toward accomplishment. We are inclined to think that they were influenced in some measure by both reasons. In passing, it may be added that so far as we are aware no other steel canal boats were in canal service until those placed there by the Federal government in 1918.

At the close of the 1901 legislative session canal affairs were in a decidedly unpromising condition. The want of harmony in the canal ranks was probably the largest factor in the failure to make progress, and harmony seemed to be the one thing which was impossible of attainment at that time. None of the canal men were opposed to improvements; no, they were all united in thinking that something must be done and that it must be done quickly, but the conservatives did not believe the people would vote the vast sum needed for the 1,000-ton project and so were willing to accept what they could get, while the radicals thought that to build anything less than the large canal was a waste of money and they were standing firmly for that or nothing. It happened that the cleavage between the two wings had also a local aspect. In the main it was New York city against the rest of the state.

During 1901, therefore, we find the two factions trying to get

together. In this they succeeded to the extent of all uniting in a renewed effort, by means of agitation and a campaign of education, to secure the adoption of necessary legislation and the approval by the people for a barge canal. In doing this work a new method of attack was adopted. The attempt was made to convince both political parties that they could no longer ignore the canal question, as had been the practice in the past, in fear of offending the rural voter.

The State Commerce Convention of 1901 met in Buffalo on October 16 to 18. This was the year of the Pan-American Exposition, which was being held in Buffalo. By that time the New York city views had gained such ascendancy that the convention went on record with practical unanimity in favor of a 1,000-ton canal and even urged on the Governor and the Legislature the necessity of providing this canal in the shortest possible time.

Late in the year 1901 there occurred an event which, although of a comparatively private nature, had a marked influence on public affairs. It was a dinner given by Gardiner K. Clark, Jr., in his home at 38 West Fifty-third street, New York city, on December 6. Mr. Clark was a public-spirited man, a friend of the canals and a member of the committee on canals of the New York Produce Exchange. To carry out a desire on the part of the Greater New York Canal Association to acquaint Governor Odell with the ideas held by New York canal men, Mr. Clark invited Governor Odell, Lieutenant-Governor Woodruff and several well-known men of affairs to meet in this social way and discuss informally the canal question. Covers were laid for eighteen and the after-dinner discussion brought out some important facts and also a certain suggestion that doubtless guided the Governor in recommending what he did to the next Legislature.

One of the men at this dinner was Andrew Carnegie and a statement he made was most interesting. He said that the Carnegie Steel Company had purchased 5,000 acres of land surrounding its port of Conneaut on Lake Erie and had plans ready to begin work at an estimated cost of \$12,000,000 and one of the reasons for selecting this site was the fact that New York was spending money in enlarging the Erie canal and also the implicit confidence he and his associates had that the State would never fail to enlarge this waterway as necessity dictated. He declared also his belief that nothing could prevent the western part of New York, along the lakes, from becoming one of the principal seats of manufacture if a suitable waterway were kept open between Buffalo and the ocean. "I am

certain," he said, "that the Empire State can maintain her position as the Empire State only by developing her manufacturing facilities through the Erie canal."

But it was Lewis Nixon who made the suggestion which bore fruit in subsequent action. His proposition was a compromise between the 1,000-ton project and the plan of completing the nine-foot deepening; it was to build new locks of the 1,000-ton size, while the canal prism should be nine feet deep, the thought being that later, if it were deemed advisable, the channel might be enlarged to correspond in size with the locks.

This scheme evidently appealed to the Governor, for he said he would consider it, and when he sent his annual message to the Legislature at the beginning of the 1902 session he proposed a plan of action which was based on this idea.

In discussing in this message the subject of canals Governor Odell said that recent investigation had convinced him that the Legislature should adopt a definite policy as to future canal expenditures. But he seems to have retained his former conception in regard to the chief function of the canal—to be a regulator of railroad rates—for he says, "One is impressed by the fact that the canals as at present conducted are sufficient for all local business, but if they are to be as they have been in the past a restraining power upon the freight rates of the railroads, then some policy to make them more serviceable to the community should be adopted." He adds, however, that he does not believe the people would sanction the expenditure of money for the sole purpose of making the canal a funnel for the traffic of the far west and that what is desired by the building up of internal commerce is to attract capital by offering inducements to manufacturers and thereby give employment to the people of the state.

In his further discussion he mentions a few very important truths. In extenuation of railroad discriminations he states that in fairness New York must recognize its own shortcomings and seek to remedy existing deficiencies. "New York itself must act," he says. "It must make it possible for the railroads to have terminal facilities equal to those of other ports. It must make it possible for the canal boat owner to have equal consideration in the matter of dockage and other essentials." He deprecates the impossibility of canal traffic getting through bills of lading, such as railroads have. This latter drawback, by the way, is only just now, after all these intervening years, being remedied and not fully at that, and moreover all through the

past it has been an obstacle but too lightly considered. Canal advocates have not always been practical transportation men and often they have failed to see the importance of this matter, but it is a factor which under present business methods will largely make or break the success of the canal.

The plan the Governor proposed at this time was the building of new locks of a capacity for thousand-ton barges and in the process reducing the number from 72 to 44 and making certain incidental changes of alignment; also the completion of the nine-foot deepening. The estimated costs of these projects, according to figures furnished the Governor by the State Engineer, were \$13,694,540 for the locks and \$15,076,936 for the deepening. The Governor made two recommendations, first, that the proposal to enlarge the locks to 1,000-ton barge capacity and to provide a new nine-foot channel from the Hudson river to Rexford Flats be submitted to the people as a separate proposition; second, that the canal be deepened to nine feet on such portions as were then less than that depth and that this proposition also be submitted to the people.

The Governor's recommendations related to the Erie canal alone. Naturally this proposal aroused considerable opposition from those who were interested in the Champlain and the Oswego canals and this caused some little delay in the introduction of a bill to carry out the Governor's suggestion. But on January 20 Senator George A. Davis of Buffalo introduced such a bill and a similar measure was introduced in the Assembly by John A. Weekes, Jr., of New York. This bill carried a bond issue of \$28,800,000.

As reported from the Senate committee the bill included the Champlain canal and the amount of money had been increased to \$31,800,000. The Senate passed the measure in this form. When it emerged from the Assembly committee both the Champlain and the Oswego canals had been added and the appropriation amounted to \$37,200,000. All these complications and the bitter feeling that had been engendered between the several localities played directly into the hands of the anti-canal forces and allowed them to score another victory. The measure was defeated, first with the Oswego canal included and then with the Oswego out.

One of the schemes adopted by the enemies of the canals during this legislative session was a concurrent resolution proposing to eliminate the constitutional prohibition against selling the canals. The resolution provided further that in the canal bed should be constructed a railroad to be used exclusively for carrying freight. This resolution was never reported out of committee.

One piece of legislation was enacted in 1902, however, which has had a direct but not widely known effect on the financial side of canal construction. This was a proposed constitutional amendment to provide for using surplus moneys in the treasury in paying interest or principal of the bonded indebtedness of the State or in forming a sinking fund to pay such indebtedness. If the surplus moneys were sufficient to meet the needs of interest and sinking fund in any year, then a direct tax for that year need not be imposed. This amendment was passed by a succeeding Legislature and in due time, after receiving an approving popular vote, became section eleven of article seven of the State Constitution. Under its provisions the State was without direct annual tax for several years in spite of being in the midst of canal and other large public works construction.

While speaking of the financial aspect of the canal question we may anticipate certain legislative action taken in 1903 which eventually amended section four of article seven of the Constitution and extended the bonding period for which State debts might be authorized from eighteen to fifty years. The early bonds for canal construction were sold prior to the time this amendment became effective, but the later bonds under authority of this provision are running for fifty years.

In the legislative contest of 1902 the New York city interests, the back-bone of the effort to secure a 1,000-ton canal, were aligned with the main body of canal men. Not that they were in hearty accord with the various measures proposed, but the building of the new locks was a step in the direction of their desires and they were willing to join the conflict in the hope that more would follow. They did their part in sending out literature to a large number of voters throughout the state. But it cannot be said that they greatly regretted the defeat of the bills, and in the end the failure of the proposed legislation of 1902 proved to be beneficial to the canal cause. The enemies of the canals, on the other hand, were pleased with their success, and among them were the railroads, which had shown again their cleverness in killing canal improvement by disingenuous but effective methods. Their pleasure, however, might have been chilled, had they perceived the real service they were rendering the canals in bringing all advocates to a united effort for the large canal project.

The failures to pass canal legislation during the sessions of 1901 and 1902 were not attributable in both years to the same causes nor indeed were they due either year to a lack of endeavor by canal men nor even to an indisposition on the part of the people of the state to do the right thing by the waterways. In 1901 the anti-

canal rural vote and the other enemies of the canals were strengthened by the ultraradical canal wing, while in 1902 they gained a controlling voice by reinforcements from the disappointed local factions.

On the whole, canal men may have been well pleased with the result of the 1902 legislative session. It is to be doubted whether the Governor's hybrid plan would have wrought anything but a temporary makeshift and a very costly one at that. But progress was being made; gradually the Governor was coming around to the barge canal idea.

In these pages we have been considering canal affairs almost to the exclusion of all other interests, but this subject was far from absorbing much of the thought of the vast majority of citizens. To be sure their orators and their statesmen had been telling them for years that upon transportation depended in great measure national and personal welfare and that adequate waterways held a large place in a proper transportation system, or as a former Governor put it, "The chief element in the prosperity of every State or Nation is the economy of transportation of persons and property. It is the most marked fact in the difference between civilization and barbarism."* And their historians had informed them that their own little Erie canal in the first half century of its existence, even in its diminutive size, had been the greatest single influence in bringing marvelous wealth and prosperity to the city and state of New York and to a wide expanse of the Middle West. But the influence of the canal was too remote and too vague to make a lasting appeal, and things which called louder and with greater insistence held the people's attention.

One of the subjects of public concern in New York state was the good roads movements. In 1898 the State had begun in a modest way the improvement of its highways. So-called highway improvement had existed of course as long as the highways themselves, but in such crude form as seldom to be worthy of the name. In the early eighties the agitation for good roads had been started by the League of American Wheelmen. The movement had been taken up by other organizations and had grown to such a size that by the time of which we are writing the Supervisors' Highway Convention, meeting on January 28, 1902, in its third annual convention, passed resolutions calling on the State for a bond issue of \$20,000,000 to

* Letter of ex-Governor Horatio Seymour to chairman of Assembly canal committee on February 27, 1882, when Constitutional amendment to abolish canal tolls was pending.

build State highways. In this movement the city dweller and the country resident stood shoulder to shoulder. For the first time in years, perhaps, the farmer arrayed himself in the ranks of public works supporters. He could easily see the direct benefit he would gain. In the case of the canals, however, the advantage was too far removed to seem real, and the fact that the cities paid nine-tenths or more of the cost of all public improvements, highways as well as canals, did not seem to weigh heavily.

In the summer and fall of 1902, moreover, the fierce political battle preceding the general election absorbed universal attention and many other things were forgotten. The reelection of Governor Odell over Bird S. Coler by a plurality of less than ten thousand votes shows how intense was the contest.

The canal question, however, had a more prominent place in this year's campaign than ever before. For the first time both political parties were forced to take serious notice of a growing sentiment for canal improvement. This came about by a determination of canal advocates to end their modest and retiring attitude and compel political recognition. To gain their object the press was used and strong editorials in certain leading publications had their effect. The Buffalo papers were the first to begin this campaign. There was some talk even of forming a canal party, but this plan did not meet with general favor, it being deemed wiser to bring so much pressure to bear on the existing organizations that neither of the two great parties should dare longer to ignore the canal question.

When the State conventions were held in the fall at Saratoga, the Republican on September 22 and the Democratic on October 1, the canal men were there in force. Committees had been appointed by the Canal Association of Greater New York and by President John D. Kernan of the State Commerce Convention and these delegates represented the strong canal centers of the state. Senator John Laughlin was chosen to present the matter to the Republican convention and Theodore S. Fassett to the Democratic convention. In the Republican assemblage John I. Platt was there in behalf of railroad interests to oppose any canal improvement plank, but the canal men prevailed and the party committed itself to the enlargement and improvement of the canals — to such an extent as fully and adequately to meet all requirements of commerce, such being in substance the language of its declaration. Although the canal people secured their plank, the rural constituency was still strong enough to influence its phraseology and the result was a statement that dealt with generalities and had little real meaning. The Democratic convention





on the other hand adopted a strong and unequivocal canal plank, which pledged the party to prepare and submit to the people immediately a plan of canal improvement that would give a 1,000-ton capacity to the Erie and Oswego canals and adequate improvement for the other State canals.

Thus the Democrats, as the "canal party," made their appeal to the voters, but this difference between the two platforms was practically nullified by Governor Odell's speech of acceptance. He had been coming around to the opinion of the canal men and in accepting the nomination for Governor he declared definitely for a 1,000-ton canal. During the campaign the friends of the canals saw to it that the candidates of both parties showed where they stood on the canal question, and these tactics compelled the political leaders to declare that their respective parties stood committed to canal improvement.

There was one occurrence soon after the State conventions which should receive our attention. Meetings were held by the Buffalo Merchants' Exchange and the New York Produce Exchange at which there was a strong sentiment in favor of committing the canal men of the state to the Democratic party because of its positive canal plank. As it turned out such action would probably have dealt the canal cause a serious if not a fatal blow. The Democrats were defeated and if the canals had shared that defeat they might never have recovered. But canal interests were not intrusted to a single party. Led by Buffalo and especially by George Clinton, resolutions in appreciation of the canal planks adopted by the two political parties were passed by both the Buffalo and New York organizations and canal men were saved from making a sad blunder.

Before continuing with the political campaign and the events which followed the election, we shall consider a few activities of the days between the adjournment of the Legislature and the beginning of the fall campaign.

In the latter part of April at a joint meeting of committees from the Greater New York Canal Association and the New York Produce Exchange a committee was appointed to confer with people from Buffalo and Oswego with reference to choosing which of the various 1,000-ton canal routes they should favor. This conference was held in Buffalo in May and State Engineer Bond was present upon invitation. After prolonged discussion and careful deliberation the route which extended by canal all the way across the state from east to west was selected, this in preference to the route by canal from the Hudson river to Oswego and thence to Buffalo by way of

Lake Ontario and either a short canal beginning at Olcott or the Niagara river with a canal around the falls.

But to digress a moment: To one who is familiar with the history of the New York canals this discussion of routes brings back most interesting memories—those of the time now nearly a century and a quarter gone when this same old question, older than the canal itself, was a burning topic. In the first days of the Republic, when the thought of a canal from the Hudson to the great interior lakes began to get hold of the early settlers it was taken for granted that it would follow the line of the natural waterways. Strangely, however, the first legislative action connected with what developed into the State canal system was a resolution looking toward a survey of the “most eligible and direct route” for a canal between the tide-waters of the Hudson river and Lake Erie, but so firmly fixed was the idea of the Ontario route, as the natural waterways route came to be known a little later, that the intention of the original resolution was disregarded, the legislators not being willing to sanction so wild a project, and for it was substituted a resolution which directed a survey of the rivers and streams along “the usual route” and such other route as the Surveyor-General might deem proper. At that time little was known of the territory where the canal eventually was built, but when the interior country was explored it took its place as a rival of the lake route and from then on, all through the agitation for the original Erie canal, the question was hotly debated, even until the time of deciding to build a canal. An early writer, speaking of the “Canal Memorial” of 1816, the famous document which turned the tide of public sentiment canalward, says, “It effectually exploded the Ontario route, and silenced forever its advocates.”

But it seems that nearly a century later the question had to be settled again and this time as before the way in which individual localities would be affected and the need of the votes of all canal territory had as much to do with the decision as the consideration of engineering features or comparative costs or of what would be best for the canal as a whole. In the Legislature of 1902 the attempt was made to put through a measure for the Erie canal alone, but without success. The survey of 1900 had shown the Mohawk-Oswego route much cheaper than the route all inland to Buffalo, but nobody was foolish enough to try to put that proposition to vote. Without the support of the western section no canal legislation could hope to succeed. During 1902 the sentiment gradually turned to the plan of using the inland route for the Erie

canal and enlarging the Oswego canal to a channel of like dimensions. The legislation of 1903 shows this development. In effect this solution of the problem of routes consisted in the choice of both and, as we shall see, this was the solution eventually approved by the people.

To enlist the press of the city in their cause the Canal Association of Greater New York and the canal committee of the New York Produce Exchange gave a dinner to the principal editors at Delmonico's on September 11, 1902, with the result that the New York papers soon were taking as lively an interest in canal affairs as were those of Buffalo.

The Republican ticket was successful in the election of 1902 and Governor Odell was reelected. Soon after the election steps were taken to draft a canal bill which should embody the ideas of canal advocates. The New York men undertook this and in doing it they availed themselves of the valuable services of Abel E. Blackmar, counsel of the New York Produce Exchange. In drafting the engineering and technical portions Mr. Blackmar was ably assisted by Major Thomas W. Symons. Also the aid and advice of George Clinton and Senator Henry W. Hill were secured in framing this measure, which it was planned to introduce in the Legislature early in the session.

Early in December a new complication arose. The Governor proposed making the route which utilized Lake Ontario between Oswego and Olcott the one to be favored. This stirred up canal men. Meetings were held in New York and Buffalo and in a few days a delegation of men from these two cities waited on the Governor and laid before him the advantages of the inland route as compared with any route which used Lake Ontario. The Governor would not commit himself, but his suggestion had had the effect of uniting all canal interests in a determination to stand for a 1,000-ton canal or nothing and also for the interior route.

CHAPTER V

THE LEGISLATIVE CONTEST OF 1903

Importance of Year 1903 in Canal History—Governor's Message Arouses to Action—Reimposition of Tolls Suggestion—Combatted by Canal Men—Governor Recommends Thousand-Ton Canal—Suggests Electric Towage May Obviate Its Necessity—Thousand-Ton Canal Bill Introduced—Hearings on Bill—Accuracy of Estimates Upheld—Revised Estimate Ordered—New Estimate Shows Large Increase in Cost—Bill Amended—Counter Bills: Railroad Schemes: Proposal to Permit Sale of Canals: Electric Towage Proposition: Bill to Reimpose Tolls: Federal Waterway Plan—Gigantic International Canal and Water-Power Project Launched—Attitude of State Press—Other Opposition—Canal Organizations Active—Canal Bill Progressed—Senate Contest—Effect of Tammany Support—Measure Passed by Senate—Assembly Approves after Strenuous Fight—Signed by Governor.

WITH but one possible exception the year 1903 is the most momentous year in New York State canal history. The only other which rivals it is 1817, the year when the State decided to build the original Erie and Champlain canals. Compared with the waterway which the people determined in 1903 to build, the canals undertaken in 1817 seem pitifully small, but considering the differences of times and conditions the State embarked on the larger enterprise in 1817 and one fraught with vastly greater difficulties and hazards. In that day the nation was young and its financial resources small. The whole state had only one-fifth the population of New York city today. Engineering was an unknown profession in America. The track of the canal was an unbroken forest or a miasmal marsh. People denounced the scheme as visionary. President Jefferson declared it a century ahead of its time. President Madison thought its cost would exceed the resources of the whole country and refused aid. The National government would not help even by granting its unsalable western lands, which the canal eventually transformed into flourishing States. For New York alone and unaided to undertake the work was considered by many as equivalent to dooming the State to bankruptcy. In derision it was said that in Clinton's "big ditch would be buried the treasure of the State, to be watered by the tears of posterity."

Strong and determined men were needed to guide the canal project in those early days and we have come to look upon them as the

leaders of their time, gifted with the most far-seeing vision, imbued with the most perfect patriotism. So, too, the men who guided the canal project of 1903 through the vicissitudes of that year and the difficulties of later years were strong and determined and history has accorded them a high place among the men of their day, and doubtless future generations, far enough removed to get the true perspective, will bestow a still higher award.

We shall have to review the events of 1903 at considerable length, so many and varied were the activities, so important and wide-reaching was the decision then made, so immense was the enterprise begun.

The Governor's annual message to the Legislature of 1903 sounded the note which aroused to action both the friends and the adversaries of the canals. There was one feature of this message which had been anticipated by some of the friends and concerning which we desire to speak now, so that later the continuity of events may not be interrupted.

The Governor said that in case the large canal scheme should receive legislative approval he would "recommend the adoption of a concurrent resolution providing for the reimposition of limited tolls, which would perhaps produce revenue enough to provide for the maintenance of the canal, believing that the lowering of the freight rates would be so great that a tollage could be easily met without interfering with the results which it hoped to accomplish under this plan."

On the 18th of December preceding, the committee on canals of the New York Produce Exchange and the sub-executive committee of the Canal Association of Greater New York had adopted a report and a resolution of a committee on tolls and had sent a copy of these to the Governor. A few of the statements contained in this report are worth quoting. Among them is a letter written by ex-Governor Horatio Seymour in 1882, when the proposition to abolish canal tolls was pending in the Legislature.

"Many seem to think," said Mr. Seymour, "that the question involved in the pending amendment is only to determine if the canals shall be supported by those who use them, or by taxation upon all parts of the State. This is very far from being a true view. Tolls are taxes of the most hurtful kind to the whole community. . . . The object of the amendment is not only to relieve our boatmen and to save our canals, but to lighten taxation in every part of the state.

That it will do this can be shown not only by reason, but more clearly by experience. When our canals were first projected, they were opposed because it was feared that, while they might benefit some sections, they would injure others away from their lines. This proved to be the reverse of the truth. The wise way to lighten taxation is to add to the wealth and prosperity of the community. Since the completion of the canals the ratio of taxation upon the extreme northern and southern sections of New York has been reduced, while the markets for their products have been improved and enlarged.

For years New York had been made to suffer under railroad discriminations and how this condition affected the question of tolls the report went on to explain. It said, "Your committee are well aware of the fact that, as far as they are informed, all foreign canals are operated under the toll system and that, therefore, is no reason why the proposed improved waterway, ranking second only to the proposed Panama canal, should form an exception to the rule. But your committee venture to urge that the Erie canal plainly occupies a position radically different from that of any other canal in that it forms the sole possible competitor of the numerous powerful and allied railroad lines leagued together for the purpose of so directing traffic as to deprive the State and City of New York of that share of commerce to which they are entitled. . . . Your committee believe that the rules applicable to other canals cannot obtain here."

The committee had made careful inquiry and had learned that the general feeling in New York city business circles was that the reimposition of canal tolls would be a step backward and a grievous blunder.

Recurring now to the Governor's message, we find him reaffirming his belief in the thousand-ton barge plan and urging most strongly upon the Legislature the necessity for immediate action, and saying, "We should recollect that above every other claim the prosperity and upbuilding of our State are foremost. While giving all weight to the expense involved, we should not be deterred from any expenditure that will hold the supremacy of which we are all justly proud."

"In my last message," he said further, "I advocated the deepening of the canals to a nine-foot level with locks capable and large enough to provide for one thousand-ton barge tonnage. To this subsequently suggestions were added that both the Oswego and the Champlain canals should be equally enlarged. This proposed measure

failed of passage, I am convinced, because of an honest belief upon the part of many members of the Legislature that the plan proposed was inadequate to meet the requirements of commerce."

Besides the proposal to reimpose tolls, of which we have already spoken, there were two other features of this message that gave encouragement to canal opponents. One was the immensity of the cost as it was made to appear if interest were included, and it was in this form that the Governor presented the project. Taking the estimate of the 1900 survey and adding interest at three per cent for fifty years the total cost, the Governor said, would be \$193,980,-967.50, and if the Champlain canal should be deepened to 12 feet, as was then desired by canal advocates, rather than to 7 feet, the whole cost, principal and interest included, would be \$215,000,000. The other feature was a suggestion that electrical equipment for rapid haulage over the existing canal might obviate the necessity of constructing a 1,000-ton canal.

On January 13, 1903, the executive committee of the Canal Association of Greater New York formally adopted the canal bill as it had been prepared by Messrs. Blackmar, Symons, Clinton and Hill and two days later it was introduced in the Assembly by Charles F. Bostwick of New York. It carried an appropriation of \$81,000,000 and provided for deepening the Erie and Oswego canals to 12 feet and the Champlain canal to 7 feet.

A conference of canal men from various parts of the state was held in Albany on January 26 and as a result the bill was modified in some respects and the bond issue was increased to \$82,000,000. In this form it was introduced in the Senate by George A. Davis, Chairman of the Senate canal committee, on January 28. One of the modifications increased the Champlain locks in the Hudson river section to the same size as those proposed for the Erie and Oswego canals.

All through the legislative contest of 1903 the adversaries of the canal were alert and persistently active. Immediately upon the introduction of the canal bill they demanded \$50,000,000 for good roads. The friends were no less vigilant and busy. They appeared in numbers at the several hearings; through their organizations they were constantly in touch with the legislative situation and were ready for all emergencies.

Three joint hearings were held on the canal bill and among the men to appear in favor of the measure were several of those who had stood by the cause for years, such men as Henry B. Hebert,

Gustav H. Schwab, William F. McConnell, Captain William E. Cleary, and William F. King of New York, and George Clinton, Henry W. Hill, John Laughlin and George H. Raymond of Buffalo; also prominent engineers who had been connected in an advisory capacity with various parts of the canal investigations, Major Thomas W. Symons, David J. Howell, George S. Morrison and William H. Burr, while Alfred Noble, then President of the American Society of Civil Engineers and in charge of the Pennsylvania railroad tunnel, sent his opinion by letter. The framer of the canal bill, Abel E. Blackmar, also appeared. In opposition there were present representatives of the State grange, those who favored a Federal ship canal or some other scheme, those who objected because of opposition to canals in general or on account of certain features of this particular canal, and also John I. Platt, who represented the railroad interests and was the most persistent and ubiquitous opponent of all.

At these hearings the trustworthiness of the State Engineer's estimates was attacked. To combat this attempt of the adversaries to discredit the figures several eminent engineers were called upon to give their opinions. What two of them said is worth noticing, even to their exact words.

In a letter to Mr. Davis, chairman of the Senate canal committee, Alfred Noble said:

"At a meeting held on February 5, 1901, the Board of Advisory Engineers, of which I was a member, adopted the following resolution:

"Resolved, That in the opinion of this Board, the work (surveys and plans) has been done thoroughly and in a manner which meets its approval, and that the estimates and reports in which the results of these surveys and work have been embodied are entitled to the confidence of the people of the State of New York."

"I voted for this resolution and still believe that the work can be done for the estimated amount approved therein, if carried on under efficient management."

William H. Burr, a professor of engineering in Columbia University and a member of the Isthmian Canal Commission, said at one of the hearings:

"The plans and estimates which are now before you were reached through a study by a body of engineers whose operations were characterized, I believe, by a degree of thoroughness and technical preparation which has never been excelled in the considera-

tion of any similar engineering question. Careful surveys were made. The board of consulting engineers and its staff not only made its own examinations through this state, but had before it a great mass of surveys and an examination of the most thorough kind made by the United States Deep Waterways Board, a large portion of whose work lay in this state along the line of the proposed waterway."

Between the first and second hearings on the canal bill, on February 10, an Assembly resolution called upon the State Engineer to make a report to that body by March 2 in answer to certain questions contained in the resolution. This move was evidently an attempt by the enemies of the bill in part to delay action but more especially to get a revised estimate, probably not for the sake of accuracy but in the hope that the figures would be so large as to defeat the project by their very size. While waiting for this report canal men could do little but try to strengthen their organization and prepare public sentiment for whatever course might be necessary when the time for further action should come.

The canal bill as originally introduced in the Senate provided for deepening the Champlain canal to only seven feet, although in the Hudson river section locks of the 1,000-ton size were to take the place of the existing structures. Naturally the people of that portion of the state were not satisfied and they zealously bestirred themselves to have the bill amended. They argued that there was fully as much reason for enlarging the Champlain branch to barge canal size as for increasing the Oswego canal to like dimensions. The tonnage records of the two waterways were compared—decidedly to the advantage of the Champlain canal—showing the tonnage of the latter during the preceding decade to be from 800,000 to 1,000,000 tons annually, while the Oswego had carried only 184,000 tons during the most prosperous year of the same decade and only 31,000 tons during the least prosperous year. The paper mills and the iron ore deposits in the Champlain region were cited as being of sufficient magnitude to demand a large canal. The prospect of Essex county iron ore being shipped in large quantities to the Buffalo steel works and thus becoming an important return cargo, was an argument of considerable weight.

On March 2 State Engineer Bond transmitted to the Legislature the report which he had made in response to the resolution of February 10. We do not need to concern ourselves with the detailed answers to each of the questions asked in the resolution; a grasp of the outstanding facts will suffice.

With reference to the accuracy of the original estimate Mr. Bond said: "The work throughout was organized in a systematic manner and carried to completion with the utmost care and thoroughness in regard to every detail, all questions as to location, method of construction, style of structures, classification of material and unit prices for estimates of cost being determined only after thorough investigation and discussion by the advisory board and myself.

"I have no hesitation, therefore, in asserting that the estimates of cost given in the barge canal report were as complete and accurate as any estimates ever prepared within the time allotted for a work of such magnitude, and that they were reliable estimates of the cost at that time for the improvement covered by the report, with the one possible exception of the allowance for unforeseen contingencies and expenses.

"It is an undisputed fact, that during the past few years the prosperity of our country has resulted in an increase in the construction of public works of all descriptions, and in the development of native resources by private capital, creating such a demand for labor and material that both have advanced in price within the past two years; furthermore, the fact of the State enlisting in an enterprise of this magnitude would have a tendency to increase the price of labor and material entering into its construction.

"My answers to the questions contained in the resolution are made after a very thorough investigation and careful analysis of the conditions now prevailing."

In the form of a summary Mr. Bond gave the following figures: The estimated cost of a 11,000-ton canal from Troy to Buffalo and from Three River Point to Oswego and of a seven-foot Champlain canal was \$80,219,172. These are figures given in the report of the 1900 survey. If one desires to get at the component parts, he may take the net total of the route we described as line A, add to it the difference in cost between a 12-foot and a 9-foot Oswego canal, as shown in the description of line B, and subtract the value of abandoned Oswego canal lands. To the \$80,219,172 there should be added \$888,943, the cost of barge canal locks on the Champlain canal from Waterford to Northumberland, and \$300,000, the estimate for constructing a lock and making necessary repairs to the Erie canal in the lumber district in Albany. Each of these pieces of work was included in the bill then pending and the additions made a total of \$81,408,115. In rounded form this was the eighty-two millions of the bill.

The estimated increase due to advanced prices for labor and materials was \$5,900,984 and this amount added made a total of \$87,309,099. Lest the ten per cent allowed in the 1900 estimate for engineering and contingencies should not be enough to cover every unforeseen difficulty or emergency, Mr. Bond added five per cent more, or \$4,365,454. This brought the revised cost for the work included in the legislative bill to a total of \$91,674,553.

We have seen that there was considerable public sentiment in favor of enlarging the Champlain canal to barge canal dimensions. In deference to this feeling Mr. Bond gratuitously included an estimate for this additional work (\$7,355,965) and at the same time he inserted an item for a junction lock near Fort Bull (\$129,168) and the cost of improving the Hudson river from Troy to Waterford and the Niagara river from Tonawanda to Buffalo (\$1,403,307 on the basis of revised prices). The necessity for the junction lock had not been discovered at the time of the 1900 estimate; it would render available as a navigable feeder a long section of the existing Erie canal. It had been hoped that the Federal government would undertake the short stretches of improvement in the Hudson and Niagara rivers. Mr. Bond thought that their cost should be included in any appropriation for the canal, since the United States might decline to do the work. In that case all the vast improvement would be largely ineffectual, because there would be a barrier at each end of the canal and boats of deep draft could not pass beyond Waterford on the east nor beyond Tonawanda on the west. Adding these three items, the grant total became \$100,562,993.

This large increase in cost was what the opponents of the canal had hoped for. Their wish had come true, but it did not work out according to their expectations. Instead of being dismayed the friends of the project changed their plans to fit the new situation and pressed on with greater zeal.

After the presentation of the State Engineer's special report a few canal men met in conference. Abel E. Blackmar represented the New York city commercial organizations and George Clinton the up-state interests and with them met Henry W. Hill. These three considered the whole question with the utmost deliberation and reached the conclusion that the Champlain canal should be improved in the same manner as the Erie and Oswego branches and that additional funds should be provided for the project. Accordingly they changed the canal bill to meet these requirements and then submitted the amended bill to a larger conference, Sena-

tor George A. Davis and Assemblymen Charles F. Bostwick and James M. Graeff being called in and meeting with them on March 10.

In its amended form the bill carried an appropriation of \$101,000,000. With the Champlain included, all of the canal advocates were united and there were not present thereafter in the Legislature of 1903 the divided interests which had characterized the sessions of 1901 and 1902, especially the latter year, when the alienation of the Oswego forces gave sufficient strength to the opposition to defeat the measure.

Before considering further the fortunes of the amended bill, let us turn for a few moments to two or three other subjects, and first we shall look at the counter projects brought forward by the adversaries in order to divert interest or directly to oppose the canal proposition.

On February 2 a concurrent resolution was introduced in the Assembly which proposed to amend the Constitution so as to authorize the State to build a railway in the bed of the canal and to least it upon certain terms. This resolution was never reported from the committee to which it was referred. Of a like nature was a proposition made by former State Senator Charles A. Stadler, who offered to form a corporation that would carry freight from Buffalo to New York in from a third to a half of the time required by canal boats and at a cost not more than by the existing canal. His plan was to build an electric or steam railway in the bed of the canal by means of which he expected to transport freight from Buffalo to Albany in 24 hours. Large boats were to be used between Albany and New York. This scheme was too visionary to give canal men much concern. Just how the new railroad was to do so much better than the existing well-equipped roads, in both rates and average time of shipment, was hard to explain.

On January 23 a concurrent resolution was introduced in the Senate proposing to amend the Constitution by striking out the section which prohibited the sale, lease or other disposal of the State canals. An attempt somewhat like this had been made to side-track canal legislation during the session of 1902. Like its predecessor of the year before this resolution too died in committee.

Another proposition was that presented to a joint meeting of the Senate and Assembly canal committees on March 11 by a company known as the International Towing and Power Company. It was a scheme of electric towage and the plan was to build on the outer

side of the tow-path certain steel construction which should carry rails on which two electric tractors could run, being able to pass each other in opposite directions and so located as not to obstruct the tow-path, which might still be used by horses for hauling boats. The proponents of this scheme estimated that boats could be towed from Buffalo to Albany for 50 cents per ton and that the electric equipment would cost about \$7,500,000.

As we have seen already, the Governor had suggested in his annual message of 1903 that electric propulsion might solve the canal problem. It is probable that his thought in this respect was influenced by a letter sent to him a few days before by ex-United States Senator Warner Miller, in which the idea was set forth in considerable detail.

It will be noticed of course that this proposition was in reality a substitute for the barge canal plan. If its success should prove as great as its advocates predicted, then there would be no need of a 1,000-ton canal. Moreover, it presupposed a tow-path or some other convenient place on which to build its tracks and in a river canalization, such as much of the proposed new canal was to be, a tow-path or other suitable place for tracks might often be lacking. It is probable, however, that as yet there was little general appreciation of what would be the nature of river canalization or of how large a proportion of the projected State canal system would be in river or lake channels. It is interesting to notice in passing that, when the debates were in progress on the canal bill a few days after this scheme was placed before the canal committees, Senator Davis, in controverting one of the chief claims for acceptance of this plan, the low cost of haulage, said that already boats were being towed by steam canal boats for 50 cents a ton from Buffalo to New York, 150 miles farther for the same amount of money.

Neither of the canal committees acted favorably upon this proposition, but in the autumn, just before election, as we shall see presently, a public demonstration of actual electric towage was given at Schenectady.

On the same day that the towage scheme was presented to the committees, Assemblyman Charles S. Plank of St. Lawrence county introduced a concurrent resolution which proposed to amend the Constitution so as to permit the reimposition of tolls on the State canals. The resolution was favorably reported from committee and passed the Assembly on April 8, with 76 votes in favor, a bare constitutional majority, and 50 votes opposed. It was then trans-

mitted to the Senate, referred to the Judiciary committee, but never reported out.

This measure too had been suggested in the Governor's message. It was opposed by canal men at this time for two reasons. In the first place probably most of them were of the opinion voiced in the resolution of the Canal Association of Greater New York that it "would mean a backward step and a regrettable reversion of the enlightened policy adopted by the people of the State in freeing the canals from any toll whatever." But more important at this particular crisis was the fact that the Constitution at that time prohibited the submission to the electorate at one and the same time both a bonding referendum and an amendment to the Constitution. This restriction, by the way, was eliminated by a constitutional amendment in 1905.

But of chief importance among the legislative measures opposed to the canal project was a bill introduced by Senator Merton E. Lewis which would authorize the Governor to appoint a commission to negotiate with the Federal government and inquire whether the United States would undertake the construction of a deep waterway between Lake Erie and the Hudson river and if so, upon what terms. Before introducing this bill Senator Lewis had presented a resolution of somewhat similar import, calling upon Congress to complete the surveys of deep waterways by an interior route and to include a full study of its possibilities for commercial and military uses and for the development of water-power. The resolution had been referred to the canal committee, where it was pigeon-holed. From its nature this bill was scarcely entitled to be the chief rival of the canal bill, but it assumed such position because its introducer came from the hotbed of anti-canal sentiment, Monroe county, and was most persistent in his opposition.

But not all the hostile activity was within the legislative halls. About the middle of March a colossal canal and water-power project was launched. Many prominent men were connected with it, but coming as it did just at this particular time and not being pushed later to fruition, one is forced to the conclusion that its purpose was primarily if not solely to divert support from the canal bill. The meeting from which this project sprang was held in the office of Andrew H. Green and a number of well-known New York city men were present. This meeting adopted a resolution calling for an international convention of all the peoples of North America and the purpose of this convention was to form an association to promote the construction of a continental system of deep

waterways and a system of water-powers and also an irrigation system for the arid lands of the continent.

A partial idea of what the scheme involved is shown by a few words of one of the speakers at the meeting. He said, "Ten billions of dollars would construct a continental system of deep sea canals and create water power equal to fifty million horse-power At the rate of \$23 a horse-power a year, fifty million horse-power would command a rental of one billion, one hundred and fifty million a year, or $11\frac{1}{2}$ per cent per year on the cost. On this basis the rental of water power would discharge the interest on the construction of the canals and water power and the cost of maintenance, and create a sinking fund for the discharge of the principal within fifty years. Competent authorities estimate the available water power on this continent to be equal to one hundred million horse-power. The system outlined would give to American vessels absolute control for all time to come of the foreign commerce of this continent without subsidies being granted them, and therefore save the two hundred million for subsidies proposed in the Hanna-Fry bill."

This meeting endorsed Senator Lewis' bill but evidently without definite knowledge of its contents, since the language of the endorsement assumed that it asked "Congress to complete surveys for a canal thirty feet deep between the Great Lakes and Atlantic tidewater."

The immensity and boldness of this scheme and the prominence of the men connected with its inception gave the project wide publicity and it was endorsed by a portion of the press, probably without due deliberation.

It will be recalled that Andrew H. Green, one of the promoters of this project and in whose office the meeting was held, had been a member of the State Commerce Commission, the body appointed by Governor Black in 1898 to inquire into the causes of the decline of New York commerce. In the debate on the canal bill a few days after this meeting Senator Grady severely scored Mr. Green for his advocacy of the Lewis bill, attributing his action to railroad affiliations.

The press of the state took an active interest in the canal question during the whole of this year of 1903. Indeed the canal problem was a live subject for the press all through this period of agitation — from the time when Governor Roosevelt appointed his committee which should formulate a State canal policy until the election of

November, 1903, when the people went to the polls and gave their decision to build the 1,000-ton canal.

The press of course was divided but the line of cleavage was unusual and so peculiar as to be difficult of explanation. In general the New York city and Buffalo papers were favorable while those of territories remote from the canals were opposed, but strangely most of the large cities on the canals were against the proposition. Rochester was almost solidly opposed. Syracuse, Utica, Albany and Troy were largely against it. The smaller canal cities, Rome, Oswego, Lockport, Tonawanda and Niagara Falls, were in favor of the new canal. So were Plattsburg and Dunkirk. Poughkeepsie, Newburgh, Binghamton, Elmira and Watertown were of the opposition. Whether these papers simply reflected the sentiment of their respective communities or were chiefly instrumental in creating it, cannot definitely be known. We are inclined to the latter opinion in many cases. Of the technical press the *Engineering News* was strong in its opposition. But such had been its customary attitude toward the New York State canals for many years. The *Journal of Commerce*, New York's great business daily, on the other hand was equally strong in its advocacy of the canal cause.

Among the arguments of the opposition the ship canal had a large place and much publicity was given to the idea that the Federal government should construct this larger waterway. The report of the Deep Waterways survey was cited and reviewed as well as other ship canal reports. It will be recalled that Major Symons said the Deep Waterways report fell flat upon its presentation because contemporaneous investigation had shown the question of relative economy and efficiency to be largely in favor of a barge rather than a ship canal.

Another form of opposition was the anti-canal propaganda placed in railway stations in the shape of circulars and pamphlets on such topics as the "Decline in Canal Traffic," "What the Railroads Have Accomplished" and "Railroads Supersede Canals." This form of attack by the railroads had the virtue of at least being open, and this cannot be said of all their acts, for canal advocates charge that more often than not the methods of these particular enemies of the canals are insidious.

There was also an opposition which arose from those who professedly and doubtless really wanted canal improvement but were restrained from favoring the particular form of improvement de-





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scribed in the pending bill because of certain local changes which would result — changes in many instances which would in some way affect them or their interests. Of such character was an objection to the canalization of the Mohawk river which was given rather wide publicity by means of circulars sent out to the public. We quote two of the ten results which according to this circular would follow the carrying out of such a scheme. From the standpoint of the present the other eight predicted results become interesting reading, but the two we are choosing attacked the project on purely engineering grounds and were absurd when the circular was written. In the light of what has now been done even the layman can perceive the absurdity.

“The canalizing of the Mohawk river,” reads the circular, “would change and contract its present current and cause it to overflow the New York Central railroad and carry away their tracks, culverts and bridges. When the river breaks up in the spring and often also during the winter, it overflows its banks and the ice rushes down with great force which would greatly damage if not totally destroy all of the permanent structures of the canalized river.

“The idea of canalizing the historic Mohawk river sounds well and may be captivating to the minds of many, but when the matter is reasoned out in all its bearings and stripped of its romance it becomes an impracticability if not an impossibility.”

We have been considering for some little time measures and arguments which were chiefly opposed to the canal bill, but both sides were equally active. While the legislative contest was going on, organizations in favor of the canals were effected in many parts of the state and representatives were sent to Albany to appear at the various hearings. Also meetings were held and resolutions were adopted. The organizations which had backed canal agitation through all these latter years kept constantly in close touch with the legislative situation. Another organization, which we have not mentioned previously but which was older than any of the others and had consistently supported every measure for canal improvement since the original State canal was begun and had even favored a proposition to connect the Great Lakes by canal with the Atlantic ocean as early as 1784, the Chamber of Commerce of the State of New York, adopted a strong canal resolution and sent copies of it to the Governor and the members of the Legislature. Throughout its long history this organization has counted among its members some of the most eminent men of the state and nation.

A piece of pro-canal propaganda put out by the New York men during this time was known as the "Canal Primer," or giving it its more comprehensive title, "The Canal System of New York State; What it was; What it is; What it has done for the Commonwealth and the Nation, and what benefits the Empire State will derive from the proposed improvements." In the form of questions and answers this pamphlet covered in a fairly complete manner the field of the origin, development and influence of the canal system of the state.

As we return now to the canal bill and trace its further course through the Legislature we can do no better than to follow closely the written account of one who was in the thick of this legislative battle and to whose zeal and watchfulness is due much if not the greater portion of the credit for the success of the canal issue. And we may profitably quote with considerable freedom the exact wording of this account. It is a part of Senator Henry W. Hill's *Waterways and Canal Construction in New York State*.

"Notwithstanding the declaration in party platforms," says Senator Hill, speaking of this particular canal bill, "a majority of the Republican leaders in both branches of the Legislature were opposed to its passage. . . . The opposition had left nothing undone to dissuade legislators from voting for it. It was characterized as a colossal scheme, wholly unwarranted in this age when canals were fast becoming a thing of the past; and it was declared that in the march of civilization waterways were giving way to railways, and a mule on the towpath was no longer a competitor of the colossal locomotive hauling from 50 to 75 loaded cars of 80,000 pounds capacity. Sarcasm, repartee and denunciation were freely indulged in by the press and in the debates on the measure."

The canal bill was reported out of the Senate canal committee on March 12, having been amended so as to include the Champlain canal and carrying the appropriation of \$101,000,000. On March 17 the Lewis bill was reported. This was the bill, it will be recalled, which provided for the appointment of a commission to negotiate with the Federal authorities relative to the construction of a ship canal across New York state. Senator Davis, the introducer of the canal bill, was successful in securing a position on the calendar for his bill ahead of the Lewis bill and it was advanced without debate to the order of third reading on March 17, with the understanding that it would be debated on the third reading and such amendments would be offered then as might have been offered in the Committee of the Whole.

Another element entering into the contest was the position taken by the two Republican senators from Erie county, Senators Hill and Davis, with reference to the excise and mortgage tax bills, which the Republican majority had planned to pass. These men insisted that the election pledge of the party be redeemed and the canal proposition be carried through before they would support these other bills. Since their votes were necessary for the passage of these measures, they had the whip-hand.

The canal referendum measure was reached on the Senate calendar on March 24 at 11:45 A. M. Thereupon Senator Lewis moved that the bill be recommitted to the canal committee with instructions that it be reported at once, amended by striking out all after the enacting clause and inserting in lieu thereof his bill authorizing the negotiations with the United States Government. In support of his motion Senator Lewis made an elaborate speech against the canal bill, in the course of which he read resolutions purporting to have been signed by more than a hundred distinguished New Yorkers, endorsing his measure. The attitude of these signers was questioned and in reply to telegrams of inquiry replies were received from some of them before the vote was taken, stating that they had signed under misapprehension and were really in favor of the canal referendum.

We do not need to follow the debates nor the many proposed amendments. The contest lasted for hours. There is only one feature among those brought out in the speeches that we care to mention here and this is a statement made by Senator Davis as to why Buffalo was so deeply interested in canal improvement. We speak of it simply because it refutes a rather prevalent idea in regard to Buffalo's attitude.

This idea, as Senator Davis said, was that Buffalo wanted the handling of the grain transfer. But this had never amounted to more than 50 cents a ton and the traffic had dwindled to almost nothing. This was not the incentive which actuated Buffalo; rather it was the prospect which a large canal offered of making that city an iron and steel center capable of delivering its products at tide-water for a lower price than could be done from any other point on the continent or perhaps in the world.

"Therefore," said Senator Davis, if we may quote a sentence here and there from his speech, "instead of the old grain traffic paying us never over 50 cents per ton, we propose to foster an industry that will pay to our people from \$5 to \$20 per ton to be expended in labor. This means an enormous increase in population along the

Niagara frontier. We propose making Buffalo the greatest manufacturing center on the lakes. At the same time we will be able to furnish all kinds of iron and steel material to all local points through the state and to New York city at prices that cannot be equalled anywhere in the country. This will culminate in manufacturing all along the canal, and will in a few years make the canal, and the river as well, the greatest manufacturing sections in the world. Buffalo has practically forgotten the grain traffic in view of the bright future opening up in other lines."

After this short digression we return to the battle being waged in the Senate chamber on that twenty-fourth day of March, 1903, and for the remainder of the chapter we shall quote directly and at considerable length from Senator Hill's account, selecting passages from his *Waterways and Canal Construction in New York State*.

"The obstacles interposed to the passage of the measure were such as to call for the utmost skill on the part of its friends to avert them. Direct and insidious attacks by way of proposed amendments were made upon it. Fortunately, the Hon. Thomas F. Grady, the most skilled parliamentarian then in the Senate, was on the alert to repel every move made to check the progress of the measure. He was in the Legislature from 1877 to 1889, and had been in the Senate continuously from 1896 to the time under notice. He was then leader of the minority, and exerted a powerful influence upon his Democratic colleagues in the Senate. During the debates, which continued five and a half hours, he received a special message from Charles F. Murphy, the leader of Tammany Hall, which read as follows:

"'My dear Senator: I desire to again remind you of the vital importance of doing everything in your power towards the passage of the canal bill, framed by the Canal Association of Greater New York. Aside from other considerations that should induce our support of this measure, is the fact that among the many distinguished citizens of our city who are agitating its passage, are many good and valued friends of the organization.'

"Senator Grady was already earnest in his support of the measure, but the impartation of this information to the other legislative members of Tammany Hall had a most salutary effect upon their attitude toward the measure."

"No parliamentarian ever exhibited greater tact during the entire day, or more materially aided in the passage of a great measure than did Senator Grady on that occasion. His steadfastness and fidelity to all canal measures — and there have been many, in support of

which he has successfully led a solid Democratic minority — entitle him to the lasting gratitude and grateful remembrance of all the people interested in the commercial development of the State.”

“During the debate on this measure the Senate galleries were thronged, and an intense interest prevailed. Those of us in charge of the measure were keenly apprehensive lest there be some wavering in the ranks of its supporters, or through some other parliamentary attack of its opponents, that it fail of passage.”

“On the final roll-call, after all adverse amendments had been voted down, the canal referendum measure received the affirmative votes of 32 Senators, and there were 14 votes against the measure on its final passage.”

“In some respects the contest in the Senate was one of the most dramatic ever witnessed. It was the culmination of a movement starting with the abolition of tolls in 1882, and then for the enlargement of locks and deepening of the prism; thereafter for the improvement known as the Seymour-Adams plan; and finally the projection of the barge canal proposition. Such a movement extending over a period of two decades very naturally aroused deep interest, and its issue was fraught with extraordinary consequences to the commerce of the State.

“Parliamentary contests usually involve matters that are largely temporal in character, which may be modified from year to year; but this project was fraught with momentous consequences to the State in that if it passed the Legislature and were approved by the people, it authorized a bond issue of one hundred and one millions, running over a period of eighteen years, which under a constitutional amendment then pending was likely to be extended over a period of fifty years. It so far transcended in importance all ordinary parliamentary contests that it called forth the best efforts of all who had any part in it, either in or out of the Legislature.

“During the long and strenuous debate the friends of the measure were intense in their advocacy of it and were called upon to defend its engineering, its fiscal and constitutional provisions, all of which were assailed by the opponents, who were equally resolute in their attacks upon it. It was the largest measure ever submitted to or considered by a legislative body in this country, and naturally aroused the deepest interest.

“The pro-canal press of the State was jubilant over the passage of the canal measure and spoke in complimentary terms of Senators Davis, Hill, Grady and Green, upon whom largely rested the burden

of carrying the measure through the Senate. Much credit is also due to the other senators who, although less conspicuous in the debates, by their votes made it possible for the canal bill to pass the Senate by a large majority vote.

"After the canal bill had passed the Senate, it was transmitted to the Assembly on March 25th, and a motion was made to advance it to the order of second reading; whereupon several amendments were offered by Assemblymen George M. Palmer, Edwin A. Merritt, John T. Dooling, John Pallace, Jr., William V. Cooke, Daniel W. Moran, Olin T. Nye, George H. Whitney, Charles S. Plank and Samuel Fowler. It was evident that the bill had encountered very fierce opposition in that body. Assemblyman John McKeown of Brooklyn immediately moved a call of the House, which was had. Assemblyman Palmer moved that the bill with the amendments be made a special order on second and third reading for Tuesday, March 31st, and that motion was determined in the negative. Thereupon Assemblymen Jean L. Burnett and Fred W. Hammond moved further amendments to the bill and after some discussion of the motion of Assemblyman Fowler, the bill, together with all amendments, was made a special order on second and third reading, for Thursday, March 26th, immediately after reading the journal.

"On the day named, when the canal bill was reached on the calendar, Assemblyman Palmer spoke in favor of his amendments; and, after a discussion by other members of the Assembly, including Assemblyman Charles F. Bostwick, of New York, the introducer of the measure, Assemblymen Robert Lynn Cox of Erie, James T. Rogers of Broome, and others, all of the Palmer amendments were voted down, as were also all other amendments to the measure that had been proposed. The opposition, however, of Assemblymen Palmer, Moran and Pallace was continued down to the final vote on the measure.

"Several Republican members who had offered amendments to the bill withdrew them during the discussion, and before the final vote Assemblyman Palmer reintroduced the same amendments and insisted on a roll call on each amendment so introduced by him. The roll call occupied two hours of the time of the Assembly and all of his amendments were voted down.

"Assemblyman Rogers, the leader of the Assembly, in withdrawing his amendment, stated that he considered that the canal advocates were entitled to have the referendum measure submitted to the people in the form in which they had framed it, and advised all

Republicans to vote down the various amendments that had been proposed. Other assemblymen took a similar position; and after a discussion running through the entire day, far into the evening, the bill passed the Assembly by 87 affirmative votes to 55 votes against it.

"The bill had been reached at 11.30 o'clock in the morning. Thirty-six amendments were offered to it altogether in the Assembly and most of them were debated until 6 P. M., when voting began on the amendments and continued for two hours.

"Assemblyman Cox made a strong speech on the bill, as did Assemblymen Charles W. Hinson and Anthony F. Burke, all of Erie county. The burden of the debate, however, fell upon Assemblyman Charles F. Bostwick of New York, the introducer of the measure, who had given the bill much study during the legislative session.

"At the conclusion of the vote in the Assembly, George H. Raymond of the Merchants' Exchange of Buffalo, remarked: 'Today has witnessed the culmination of eight years of labor on the part of the business interests of the State to secure for all time to our people the enjoyment of a free waterway between the Great Lakes and the sea. . . . We are now to undertake the greatest public work ever proposed in this country, and the results will be beyond the wildest dreams of its friends.'

"On April 7th, at 11.35 a. m., Governor Odell gave his official approval to the canal referendum measure in the presence of Senator George A. Davis and myself, and Messrs. G. K. Clark, Jr., John D. Trenor of the Greater New York Canal Association, and S. C. Mead, secretary of the Merchants' Association of New York; and it became chapter 147 of the laws of 1903 of New York."

CHAPTER VI

THE CANAL CAMPAIGN OF 1903

Contest Transferred to Electorate of State—Text of Bill—Special Features: Cost to Be Borne by Whole State: Route Largely River Canalization: Principal Canal Dimensions: Canal Board the Governing Body: Governor's Responsibility: State Engineer Directly Responsible: Manner of Making Contracts: Certain Restrictions—Final Contest On—Campaign of Education—Dinner at Buffalo—Campaign Organizations—New York City Press—Canal Literature—Endorsement by Labor Unions—Support through Political Parties—Nature of Opposition—Sample of Its Literature—Anti-Canal State Convention—Letter Issued by Sixteen Senators—Specimen of Unscrupulous Literature—Canal Dinner at Utica—Various Meetings—Public Debates—School Debates—Other Meetings—New York City the Chief Battle Ground—Reparation for Opposition to Original Canal—City Organization—Dinner to Metropolitan Press—Cart-Tail Campaign—Mass Meeting at Produce Exchange—Supreme Court Decision Used by Opposition—Publication of Letter by Canal Men—Demonstration of Electric Towing—Names of Certain Men Responsible for Success of Canal Cause.

THE legislative contest of 1903, as we have just seen, was most heated, but the final victory was by no means won with the signature of the Governor. Indeed the campaign had only begun. The two armies simply had transferred their battlefield from the Legislature to the electorate of the whole state.

But before viewing the new engagements of the opposing forces we shall look for a little while at the bill itself, and first we shall transcribe it in its entirety, both because it is an important document and should be read if one is to understand the scope and character of the new venture and also in order that it may be at hand for various references we shall have to make to it from time to time. At the end of this transcript we shall speak briefly of some of the outstanding features of the law.

In various publications of this law it has been found useful to print marginal annotations consisting of descriptions, expressed in the fewest possible words, of the subject matter of the text. These annotations, which may well be called marginal heading and sub-heads, are repeated in the present reprint. Also at the close of the several sections there are printed, enclosed within parentheses, references to amendments affecting the particular section or pertinent

explanatory statements. Sections added by later amendments are given their proper places and what they relate to is briefly stated, but the text is not included. With the exceptions just noted the following copy is the bill which was voted on by the people in 1903, not the law as it has been amended from time to time.

CHAPTER 147, LAWS OF 1903

AN ACT making provision for issuing bonds to the amount of not to exceed one hundred and one million dollars for the improvement of the Erie canal, the Oswego canal and the Champlain canal and providing for a submission of the same to the people to be voted upon at the general election to be held in the year nineteen hundred and three.

Became a law, April 7, 1903, with the approval of the Governor. Passed, three-fifths being present.

The People of the State of New York, represented in Senate and Assembly, do enact as follows:

Section 1. There shall be issued in the manner and at the ^{Bonds.} times hereinafter recited, bonds of the State in amount not to exceed one hundred and one million dollars, which bonds shall be sold by the State, and the proceeds thereof paid into the State treasury and so much thereof as shall be necessary expended for the purpose of improving the Erie canal, the Oswego canal and the Champlain canal, and the procurement of the lands required in connection therewith. The said bonds ^{Bonds exempt.} when issued shall be exempt from taxation. (See sec. 1 of chap. 302, Laws of 1906, and sec. 1 of chap. 66, Laws of 1910. Emergency appropriation of \$3,654,000, chap. 706, Laws of 1915. Bond issue of \$27,000,000, chap. 570, Laws of 1915.)

§ 2. The Comptroller is hereby directed under the super- ^{Bond issue.} vision of the Commissioners of the Canal Fund, to cause to be prepared the bonds of this State, to an amount not to exceed one hundred and one million dollars, the said bonds to bear interest at the rate of not to exceed three per centum per ^{Interest.} annum, which interest shall be payable semi-annually in the city of New York. Said bonds shall be issued for a term of ^{Term.} not more than eighteen years from their respective dates of issue, and shall not be sold for less than par. The Comptroller is hereby charged with the duty of selling said bonds to the ^{Sale and advertising.} highest bidder after advertising for a period of twenty consecutive days, Sundays excepted, in at least two daily newspapers printed in the city of New York and one in the city of Albany. Said advertisements shall contain a provision to the effect that the Comptroller in his discretion may reject any or all bids made in pursuance of said advertisements, and in the event of such rejection, the Comptroller is authorized to readvertise for bids in the manner above described as many times as in his

- judgment may be necessary to effect a satisfactory sale. The said bonds shall not be sold at one time; not more than ten million dollars in amount thereof shall be sold during the two years next ensuing after this act takes effect and thereafter they shall be sold in lots not exceeding ten million dollars at a time as the same may be required for the purpose of making partial or final payments on work contracted for in accordance with the provisions of this act, and for other payments lawfully to be made under the provisions hereof. There is hereby imposed for each year after this act goes into effect until all the bonds issued under the authority of this act shall be due, an annual tax of twelve one-thousandths of a mill upon each dollar of valuation of the real and personal property in this state subject to taxation, for each and every one million dollars or part thereof in par value of said bonds issued and outstanding in any of said fiscal years, the annual amount of such tax to be computed by the Comptroller, which taxes shall be assessed, levied and collected by the annual assessment and collection of taxes of each of such years in the manner prescribed by law and shall be paid by the several county treasurers into the treasury of the State, and the proceeds of said tax, after paying the interest due upon the outstanding bonds shall be invested by the Comptroller under the direction of the Commissioners of the Canal Fund, and, together with the interest arising therefrom, shall be devoted to the sinking fund which is hereby created, payment from which shall only be made to the extinguishment of the indebtedness created by the sale of the aforesaid bonds as the said bonds become due and for no other purpose whatever. (See sec. 2 of chap. 302, Laws of 1906, and chap. 241, Laws of 1909, also sec. 2 of chap. 66, Laws of 1910, and chap. 186, Laws of 1912. Rate of interest on certain bonds, $4\frac{1}{2}$ per cent, see chap. 787, Laws of 1913.)
- Tax.**
- Sinking fund.**
- Commencement of work.**
- Route, Eastern Division, Erie canal.**
- § 3. Within three months after issuing the said bonds or some part thereof the Superintendent of Public Works and the State Engineer are hereby directed to proceed to improve the Erie canal, the Oswego canal and the Champlain canal in the manner hereinbelow provided. The route of the Erie canal as improved shall be as follows: Beginning at Congress street, Troy, and passing up the Hudson river to Waterford; thence to the westward through the branch north of People's island and by a new canal and locks reach the Mohawk river above Cohoes falls; thence in the Mohawk river canalized to Little Falls; thence generally by the existing line of the Erie canal and feeder around through Little Falls to the Mohawk river above the upper dam; thence in the Mohawk river canalized with the necessary cutting through bends to a point just east of Jacksonburg; thence generally by the existing line of the Erie canal to Herkimer; thence in the valley of the Mohawk river following the thread of the stream

as much as practicable to a point about six miles east of Rome; thence over to and down the valley of Wood creek to Oneida lake; thence through Oneida lake to the Oneida river; thence down the Oneida river cutting out the bends thereof where desirable, to Three River Point; thence up the Seneca river to the outlet of Onondaga lake; thence still up the Seneca river to and through the State ditch at Jack's reefs; thence westerly generally following said river to the mouth of Crusoe creek; thence substantially paralleling the New York Central railroad and to the north of it to a junction with the present Erie canal about one and eight-tenths miles east of Clyde; thence following substantially the present route of the canal with necessary changes near Lyons and Newark to Fairport; thence curving to the south and west on a new location joining the present canal about one-half mile west of the crossing of the Irondequoit creek; thence following the old canal to a point about one and one-fourth miles west of Pittsford; thence following the existing line of the canal for nearly a mile; thence running across the country south of Rochester to the Genesee river near South Park; here crossing the river in a pool formed by a dam; thence running to the west of the outskirts of Rochester and joining the present canal about one mile east of South Greece; thence following substantially the route of the present Erie canal with the necessary change in alignment near Medina to a junction with the Niagara river at Tonawanda, thence by the Niagara river and Black Rock harbor to Buffalo and Lake Erie. The existing Erie canal from Tonawanda creek to Main street, Buffalo, shall be retained for feeder and harbor purposes. The route of the Oswego canal as improved shall be as follows: Beginning at the junction of the Oswego, Seneca and Oneida rivers, it shall run northward to a junction with Lake Ontario at Oswego, following the Oswego river canalized and present Oswego canal. The route of the Champlain canal as improved shall be as follows: Beginning in the Hudson river at Watford, thence up the Hudson river canalized to near Fort Edward; thence via the present route of the Champlain canal to Lake Champlain near Whitehall. The routes as specified herein shall be accurately laid down upon the ground by the State Engineer, who is hereby authorized and required to make such deviations therefrom as may be necessary or desirable for bettering the alignment, reducing curvature, better placing of structures and their approaches, securing better foundations, or generally for any purpose tending to improve the canal and render its navigation safer and easier. The Erie, Oswego and Champlain canals shall be improved so that the canal prism shall, in regular canal sections, have a minimum bottom width of seventy-five feet and a minimum depth of twelve feet and a minimum water cross section of eleven

Route, Middle
Division, Erie
canal.

Route, Western
Division, Erie
canal.

Route, Oswego
canal.

Champlain
canal.

Prism.

Locks.

hundred and twenty-eight square feet, except at aqueducts and through cities and villages where these dimensions as to width may be reduced and cross section of water modified to such an extent as may be deemed necessary by the State Engineer and approved by the Canal Board. In the rivers and lakes the canal shall have a minimum bottom width of two hundred feet, minimum depth of twelve feet and minimum cross section of water of twenty-four hundred square feet. The locks for the passage of boats on the Erie, Oswego and Champlain canals shall be single locks, except at the flight of three locks near Waterford, and of two locks at Lockport which shall be double locks. The locks shall have the following governing dimensions: Length between hollow quoins, three hundred and twenty-eight feet, clear width twenty-eight feet, minimum depth in lock chamber and on mitre sills eleven feet, and with such lifts as the State Engineer may determine. The locks shall be provided with all necessary approach walls by passes, gates and valves, with hydraulic or electrical power for the manipulation of gates and valves, for expediting the passage of boats through the locks, and for lighting the locks and approaches. All locks having over eight feet lift shall be fed through a culvert running parallel with the axis of the lock in each wall with the necessary feed and discharge pipes and controlling valves. All single locks shall be so located with reference to the axis of the canal, that a second lock can be conveniently added alongside the first should this hereafter be found necessary. The Erie, Oswego and Champlain canals shall be provided with all necessary spillways, culverts and arrangements for stream crossing; the bottom and sides shall be puddled wherever necessary, and the sides where necessary shall have vertical masonry walls, or slope wash walls; guard locks and stop gates shall be built where required, and in canal sections guard gates shall be built at distances apart not exceeding ten miles, all as may be determined by the State Engineer. New bridges shall be built over the canals to take the place of existing bridges wherever required, or rendered necessary by the new location of the canals. All fixed bridges and lift bridges when raised shall give a clear passage way of not less than fifteen and one-half feet between the bridge and the water at its highest ordinary navigable stage. The dams required for the canalization of the river sections of the Erie, Oswego and Champlain canals shall be so located and shall be built of masonry or timber as the State Engineer shall determine to be best. Wherever, in the canalized rivers or in Oneida or Cross lakes, it may be deemed by the State Engineer necessary for the safety and convenience of navigation, spar, gas, can or lantern buoys, range lights or range targets shall be provided, placed and maintained. The eastern end of the existing Erie canal at

**Spillways,
culverts, etc.****Guard gates.****Bridges.****Dams.****Buoys, etc.**

its junction with the Hudson river shall be improved as follows: A lock shall be built in place of existing lock number one and the weigh lock near it at Albany with the following governing dimensions: length between hollow quoins one hundred and seventy-eight feet, clear width twenty-eight feet, minimum depth on mitre sills eleven feet, and the canal prism shall be improved as far as existing lock number two by giving it depth of twelve feet and a minimum width of fifty-five feet. And at the point of divergence from the present Erie canal near Fort Bull a lock shall be constructed with the following governing dimensions: Length between hollow quoins one hundred and seventy-eight feet, clear width twenty-eight feet, minimum depth on mitre sills eleven feet, and shall be so located and constructed that boats navigating the proposed improved canal will be able to lock into the present Erie canal at this point; and that portion of the present Erie canal lying between the point above described and the Orville or Butternut creek feeder shall be maintained as a navigable canal and feeder of its present size and depth. The outlet of Onondaga lake into the Seneca river shall be enlarged to the size prescribed for the prism of the Erie and Oswego canals, and the necessary improvements shall be made in Onondaga lake to permit canal boats to reach the head of the lake, and from the head of the lake and extending southeastwardly into Syracuse where there shall be constructed a harbor or basin twelve hundred feet in length, two hundred and twenty feet in width and twelve feet in depth. From the pool in which the canal will cross the Genesee river south of Rochester, there shall be constructed generally on the site of the old feeder northwardly towards Rochester, a canal of the size prescribed for the prism of the Erie, Oswego and Champlain canals and about two and one-quarter miles long ending at the present Erie canal. The northerly end of this canal for a distance of fifteen hundred feet shall be enlarged into a basin or harbor with a width of one hundred and seventy feet and depth of twelve feet. The additional water supply required for the improved Erie canal shall be provided by developing and utilizing existing sources, by constructing a storage reservoir on Limestone creek, improving the storage of Cazenovia lake, and building storage reservoirs on the upper Mohawk near Delta and on West Canada creek near Hinckley, with all necessary feeders for connecting these and existing reservoirs with the improved canal. The supply of water for the Erie canal shall be sufficient for the uses of the canal with at least ten million tons of freight carried on it per year. (Amended by chap. 740, Laws of 1905, chap. 710, Laws of 1907, chap. 508, Laws of 1908, chap. 83, Laws of 1910, and sec. 3 of chap. 801, Laws of 1913. Improvement of canal basin at Albany, chap. 263, Laws of 1914. Retention of old

Lock at
junction of
Erie canal and
Hudson river.

Lock at
Fort Bull.

Orville feeder.

Onondaga
outlet.

Onondaga
lake.

Improvement
at Rochester.

Water supply.

canal from Waterford to Erie lock No. 2, chap. 243, Laws of 1913. Retention of old canal from Schuylerville to Northumberland, chap. 412, Laws of 1914. The terminals mentioned in this section were affected by sec. 4 of chap. 746, Laws of 1911.)

Appropriation
of lands, etc.

Appropriation
surveys and
maps.

Service of
notice of
appropriation.

Compensation
for lands, etc.

§ 4. The State Engineer may 'enter upon, take possession of and use lands, structures and waters, the appropriation of which for the use of the improved canals and for the purposes of the work and improvement authorized by this act, shall in his judgment be necessary. An accurate survey and map of all such lands shall be made by the State Engineer who shall annex thereto his certificate that the lands therein described have been appropriated for the use of the canals of the State. Such map, survey and certificate shall be filed in the office of the State Engineer, and a duplicate copy thereof, duly certified by the State Engineer to be such duplicate copy shall also be filed in the office of the Superintendent of Public Works. The Superintendent of Public Works shall thereupon serve upon the owner of any real property so appropriated a notice of the filing and of the date of filing of such map, survey and certificate in his office, which notice shall also specifically describe that portion of such real property belonging to such owner which has been so appropriated. If the Superintendent of Public Works shall not be able to serve said notice upon the owner personally within this state after making efforts so to do, which in his judgment are under the circumstances reasonable and proper, he may serve the same by filing it with the clerk of the county wherein the property so appropriated is situate. From the time of the service of such notice, the entry upon and the appropriation by the State of the real property therein described for the purposes of the work and improvement provided for by this act, shall be deemed complete, and such notice so served shall be conclusive evidence of such entry and appropriation and of the quantity and boundaries of the lands appropriated. The Superintendent of Public Works may cause a duplicate copy of such notice, with an affidavit of due service thereof on such owner, to be recorded in the books used for recording deeds in the office of the county clerk of any county in the state where any of the property described in such notice is situated; and the record of such notice and such proof of service shall be prima facie evidence of the due service thereof. The Court of Claims shall have jurisdiction to determine the amount of compensation for lands, structures and waters so appropriated. (Amended by sec. 4 of chap. 365, Laws of 1906, chap. 196, Laws of 1908, chap. 273, Laws of 1909, chap. 468, Laws of 1911, chap. 736, Laws of 1911, and sec. 4 of chap. 801, Laws of 1913. Part payment for appropriated lands, chap. 708, Laws of 1913. Time for filing existing claims extended, chap. 640, Laws of 1915. Appropriation of rights and easements, chap. 420,

Laws of 1916. Appraisal of lands, structures and waters provided by chap. 335, Laws of 1904. See also chap. 195, Laws of 1908, chap. 286, Laws of 1910, chap. 334, Laws of 1910, and chap. 448, Laws of 1915.)

§ 4-a. (This section, inserted by chap. 63, Laws of 1910, relates to the necessary removal of cemeteries, etc.)

§ 5. Whenever any lands now used for canal purposes shall be rendered no longer necessary or useful for such purposes by reason of the improvement hereby directed, the same shall be sold in the manner provided by law for the sale of abandoned canal lands and the net proceeds thereof paid into the State treasury, and so much thereof as shall be necessary shall be applied to the cost of the work hereby directed. (Amended by chap. 244, Laws of 1909, and chap. 511, Laws of 1915. The sale of abandoned canal lands is provided in chap. 50, Laws of 1909, constituting chap. 46 of the Consolidated Laws, portions of which are amended by chap. 299, Laws of 1916.)

§ 5-a. (This section, inserted by chap. 180, Laws of 1909, relates to bridges over portions of present canals to be abandoned and navigable streams.)

§ 6. All the work herein authorized shall be done by contract. Before any such contract shall be made the State Engineer shall divide the whole work into such sections or portions as may be deemed for the best interests of the State in contracting for the same, and shall make maps, plans and specifications for the work to be done and materials furnished for each of the sections into which said work is divided and shall ascertain with all practicable accuracy the quantity of embankment, excavation and masonry, the quantity and quality of all materials to be used and all other items of work to be placed under contract and make a detailed estimate of the cost of the same, and a statement thereof with the said maps, plans and specifications, when adopted by the Canal Board, shall be filed in his office and a copy thereof shall be filed in the office of the Superintendent of Public Works and publicly exhibited to every person proposing or desiring to make a proposal for such work. The quantities contained in such statement shall be used in determining the cost of the work according to the different proposals received, and when the contracts for any such work are awarded, every such statement, with the maps, plans and specifications and all other papers relating to such work advertised and which may be necessary to identify the plan and extent of the work embraced in such contracts shall be filed in the office of the State Engineer with a certificate of the Superintendent of Public Works stating the time and place of their exhibition. No alteration shall be made in any such map, plan or specification, or the plan of any work under contract during its progress, except with the consent and

Sale of
abandoned
canal lands.

Contracts,
maps, plans,
etc.

Bids.

Alterations.

approval of the Superintendent of Public Works and the State Engineer, nor unless a description of such alteration and such approval be in writing and signed by the parties making the same and a copy thereof filed in the office of the State Engineer. No change of plan or specification which will increase the expense of any such work or create any claim against the State for damage arising therefrom shall be made unless a written statement, setting forth the object of the change, its character, amount and the expense thereof, is submitted to the Canal Board, and their assent thereto at a meeting when the State Engineer was present is obtained. No extra or unspecified work shall be certified for payment unless said work is done pursuant to the written order of the State Engineer and payment therefor shall not be made unless approved by the Canal Board. (Amended by chap. 394, Laws of 1907, and sec. 6 of chap. 736, Laws of 1911. Contract obligations limited, sec. 3 of chap. 302, Laws of 1906, and sec. 3 of chap. 66, Laws of 1910.)

Extra work.

Advertising.

§ 7. All the work herein specified shall be done by contract executed in triplicate as required by law and entered into by the Superintendent of Public Works on the part of the State after having been advertised once a week for four successive weeks in two newspapers published in the city of New York, one of which shall be published in the interests of engineering and contracting and one each in the cities of Albany, Rochester, Buffalo and Syracuse and one in each county where the particular piece of work advertised or some portion of the same is located, and it shall be the duty of the Superintendent of Public Works to combine in one notice of advertisement as many pieces of work as practicable. The advertisements shall be limited to a brief description of the work proposed to be let with an announcement stating where the maps, plans and specifications are on exhibition and the terms and conditions under which bids will be received and the time and place where the same will be opened, and such other matters as may be necessary to carry out the provisions of this act. The proposals received pursuant to said advertisements shall be publicly opened and read at the time and place designated. Every proposal must be accompanied by a money deposit in the form of a draft or certified check upon some good banking institution in the city of Albany or New York, issued by a National or State bank in good credit within the state, and payable at sight to the Superintendent of Public Works for five per centum of the amount of the proposal. In case the proposer to whom such contract shall be awarded shall fail or refuse to enter into such contract within the time fixed by the Superintendent of Public Works, such deposit shall be forfeited to the State, paid to the State Treasurer and become a part of the canal fund. In case the contract be made such deposit

**Opening of
bids and
award of
contract.**

shall be returned to the contractor. In cases where the estimated cost of the materials and work does not exceed ten thousand dollars, the period of advertising may be abridged and the work may be advertised by circular letters and posters when, in the judgment of the Superintendent of Public Works approved by the Canal Board, such course may be desirable or necessary. The Superintendent of Public Works may reject all the bids and readvertise and award the contract in the manner herein provided, whenever in his judgment the interests of the State will be enhanced thereby. No contract which exceeds by more than ten per centum the gross cost of the work as estimated by the State Engineer or by more than twenty per centum the cost of any item therein shall be awarded unless such award shall be approved by the State Engineer and the Canal Board. The contract in a form to be approved by the Attorney-General shall be made with the person, firm or corporation who shall offer to do and perform the same at the lowest price and who shall give adequate security for the faithful and complete performance of the contract, and such security shall be approved as to sufficiency by the Superintendent of Public Works, and as to form by the Attorney-General and shall be at least twenty-five per centum of the amount of the estimated cost of the work according to the contract price. If in the judgment of the State Engineer the work upon any contract is not being performed according to the contract or for the best interests of the State, he shall so certify to the Canal Board, and the Canal Board shall thereupon have power to suspend or stop the work under such contract while it is in progress and direct the Superintendent of Public Works, and it shall thereupon become his duty, to complete the same in such manner as will accord with the contract specifications and be for the best interests of the State, or the contract may be cancelled and readvertised and relet in the manner above prescribed, and any excess in the cost of completing the contract beyond the price for which the same was originally awarded shall be charged to and paid by the contractor failing to perform the work. If at any time in the conduct of the work under any contract, it shall become apparent to the State Engineer that any item in the contract will exceed in quantity the engineer's estimate by more than fifteen per centum, he shall so certify to the Canal Board and the Canal Board shall thereupon determine whether the work in excess thereof shall be completed by the contractor under the terms and at the prices specified in the contract or whether it shall be done or furnished by the Superintendent of Public Works, or whether a special contract shall be made for such excess in the manner above prescribed. Every contract shall reserve to the Superintendent of Public Works the right to suspend or cancel the contract as above provided and to com-

Advertising
abridged.

Rejection of
bids.

Excessive
bids.

Contract
made.

Securities.

Power to
suspend, or
stop the
work.

15 % excess.

Right to
suspend or
cancel contract
and complete
work.

plete the same or readvertise and relet the same as the Canal Board may determine, and also shall reserve to the Superintendent of Public Works the right to enter upon and complete any item of the contract which shall exceed in quantity the engineer's estimate by more than fifteen per centum or to make a special contract for such excess, as the Canal Board may determine. (Amended by chap. 267, Laws of 1909. Contract obligations limited, sec. 3 of chap. 302, Laws of 1906, and sec. 3 of chap. 66, Laws of 1910.)

Advisory
Board of
Consulting
Engineers.

Special
Deputy State
Engineer.

Resident
Engineers.

Payments to
contractors.

Estimates.

Navigation
where work is
in progress.

§ 8. The Governor may employ, at a compensation to be fixed by him, five expert civil engineers to act as an Advisory Board of Consulting Engineers, whose duty it shall be to advise the State Engineer and the Superintendent of Public Works, to follow the progress of the work and from time to time to report thereon to the Governor, the State Engineer and the Superintendent of Public Works, as they may require or the board deem proper and advisable. The State Engineer may appoint and at pleasure remove a special deputy, at a compensation to be fixed by him with the approval of the Canal Board, who may, under the direction of the State Engineer, perform on the work of improvement authorized by this act all the duties of the State Engineer, except as commissioner, trustee or member of any board. The State Engineer may also appoint and at pleasure remove such number of resident engineers in addition to those now authorized by law as he may deem necessary for the work of improvement hereby authorized and may prescribe and define their duties. (Amended by sec. 8 of chap. 736, Laws of 1911.)

§ 9. The Superintendent of Public Works may, from time to time, upon the certificate of the State Engineer, pay to the contractor or contractors a sum not exceeding ninety per centum of the value of the work performed, and such certificate of the State Engineer must state the amount of work performed and its total value, but in all cases not less than ten per centum of the estimate thus certified must be retained until the contract is completed and approved by the State Engineer and the Superintendent of Public Works. (Amended by chap. 416, Laws of 1914.)

§ 10. All measurements, inspections and estimates shall be made by the State Engineer and the engineers and inspectors appointed by him. The Superintendent of Public Works may, in the performance of the duties devolving upon him by this act, rely upon the certificates of the State Engineer and his assistants as to the amount, character and quality of the work done and material furnished.

§ 11. While the work contemplated in this act is in progress the canals upon which work is actually being done shall not be open for navigation earlier than May fifteenth and shall be closed on or before November fifteenth, except that por-

tions thereof may be opened earlier and closed later when in the judgment of the Superintendent of Public Works such a course will not be detrimental to the progress of the work of improvement.

§ 12. All questions which under the provisions of this act are to be determined by the Canal Board, shall be decided by a majority vote of all members of such board, and a full and complete record of all proceedings of such board shall be preserved, and a certified copy of its determination or action upon any question arising under this act shall be transmitted to the State Engineer. Canal Board duties.

§ 13. The sum of ten million dollars is hereby appropriated, payable out of the moneys realized from the sale of bonds as provided by section two of this act, and from the proceeds of the sale of abandoned lands as provided in section five of this act, to be expended to carry out the purposes of this act; said sum of ten million dollars to be paid by the Treasurer on the warrant of the Comptroller, after due audit by him, upon the presentation of the draft of the Superintendent of Public Works to the order of the contractor if for construction work, or to his own order if for the completion by him of any unfinished contract or for advertising for miscellaneous expenses connected with the said work, or upon the presentation of the drafts of the State Engineer for supervising or engineering expenses in connection with said work, or upon the presentation by the Comptroller of accounts for miscellaneous expenses, or on the presentation of awards by the Court of Claims for compensation for lands appropriated as provided in section four of this act or damages caused by the work of improvement hereby authorized. (Amended by sec. 13 of chap. 365, Laws of 1906.) Appropriation

§ 14. Any surplus arising from the sale of bonds and the sale of abandoned lands over and above the cost of the entire work of the improvement of the canals as heretofore provided for shall be applied to the sinking fund for the payment of said bonds. (See also sec. 4 of chap. 302, Laws of 1906, and sec. 4 of chap. 66, Laws of 1910.) Surplus funds.

§ 15. This law shall not take effect until it shall at a general election have been submitted to the people, and have received a majority of all the votes cast for and against it at such election; and the same shall be submitted to the people of this State at the general election to be held in November, nineteen hundred and three. The ballots to be furnished for the use of voters upon the submission of this law shall be in the form prescribed by the election law and the proposition or question to be submitted shall be printed thereon in substantially the following form, namely: "Shall chapter (here insert the number of this chapter) of the laws of nineteen hundred and three, entitled 'An act making provision for When law shall take effect.

issuing bonds to the amount of not to exceed one hundred and one million dollars for the improvement of the Erie canal, the Oswego canal and the Champlain canal, and providing for a submission of the same to the people to be voted upon at the general election to be held in the year nineteen hundred and three' be approved?"

§ 16. (This section, added by chap. 494, Laws of 1907, relates to the lease and sale of water.)

§ 17. (This section relates to the sale of materials encountered in excavation and not necessary for improvement work. It was added by chap. 320, Laws of 1909, and amended by chap. 149, Laws of 1915.)

This is what is known familiarly as the Barge Canal Law. Anticipating the affirmative vote of the people, we may for a few minutes discuss this bill as the act under which the construction of the new canal was soon to begin.

Noticing only a few of its many features, we observe first in order of textual sequence that the cost was to be borne by the whole state and not by the canal-bordering counties, as recommended by the State Canal Committee in its report of January 15, 1900. The Committee's financial plan had soon run against the objection of probable unconstitutionality and had been discarded. Moreover, it had been shown that the cities along the canal, even the cities of New York and Buffalo alone, paid so large a share of all State expenditures, every public improvement as well as the proposed canal, that the small remaining portion, something less than ten per cent, was insignificant when distributed over the remainder of the state.

The route laid down in the bill deviates so widely from the course of the existing canal that it calls for comment. This divergence of routes, however, is simply the result of a difference between two types of canal-building that are even more widely separated than the locations themselves; it is the difference between the canalized river and the independent canal. Up to the commencement of the Barge canal New York had had little experience in river canalization, as we understand the term today, except in the use of the Hudson river, which had never been considered as really a part of the canal system. Its nearest approach to river canalization had been the channels in Oneida and Black rivers, which had been improved slightly for a rather limited use by steamboats, and a few stretches in the Oswego and Seneca rivers, along the banks of which tow-paths had been built. Indeed river canalization is the product of comparatively recent engineering science.

The historical setting in New York state of the changes from river to canal and back again is somewhat interesting. New York is blessed by nature above all her sister states on the Atlantic seaboard in the matter of watercourses. She possesses a chain of rivers stretching more than three-quarters of the distance to the great inland seas that lie in the heart of the continent, and the mightiest of these rivers has cut a sea-level channel through the coast range of mountains, while no other river reaching the Atlantic ocean in this country is navigable to within many miles of this range. Before the advent of the white man the Indians for untold years had been using these natural avenues of travel and the first European settlers followed the same routes. But when they tried to adapt the streams to larger commercial use, they ran afoul of troubles too difficult for the skill of their day to overcome. Not only in America but in Europe as well this was the experience at that time. As Benjamin Franklin in a letter from London in 1772 quaintly puts it, "Rivers are ungovernable things, especially in hilly countries. Canals are quiet and very manageable." The first attempt to provide improved navigation in New York state was made by a private company and its field of endeavor lay in the beds of the natural streams. Before the State had begun its own first canal, however, the usual practice of the time had been adopted. In their report of 1811 the canal commissioners had said, "Experience has long since exploded in Europe the idea of using the beds of rivers for internal navigation." But now, at the beginning of the Barge canal, engineers had succeeded in making rivers sufficiently quiet and manageable to be used for navigation purposes and the State canals were to go back to the channels used for nobody knows how many centuries by the aboriginal possessors of the land.

The Barge canal law was explicit in general in its requirements as to the route, but at the same time it was not so rigid as to preclude minor deviations. In the course of construction it has happened that several changes of location have been made and in a few cases the desired change has run counter to the law and it has been necessary for the Legislature to pass an amendment before that particular new location could be occupied. It will be noticed that some cities, Syracuse and Rochester especially, are not on the direct route, but are reached through spur lines. In the case of Schenectady and Utica, also, shorter spurs have been constructed to reach their respective terminals.

For convenience it seems well to state here concisely the sizes of prism and locks and the amount of clearance at bridges, as set forth in the law. The minimum prism dimensions in land line were: Bottom width, 75 feet; depth of water, 12 feet; water cross-section, 1,128 square feet, except at aqueducts and through cities and villages, where width and cross-sectional areas might be modified. Minimum prism dimensions in river and lake channel: Bottom width, 200 feet; depth of water, 12 feet; cross-section of water, 2,400 square feet. Governing dimensions of locks: Length between hollow quoins, 328 feet; clear width, 28 feet; minimum depth of water in lock chamber and on miter-sills, 11 feet. Clearance between water-surface and bridges, not less than 15½ feet.

The law made the Canal Board the supreme governing body for constructing the new canal. This board consists of six elective State officials, the Lieutenant-Governor, the Secretary of State, the Comptroller, the Treasurer, the Attorney-General and the State Engineer and Surveyor, and one appointive official, the Superintendent of Public Works. The board was created in 1826, the next year after the completion of the original Erie canal, and has always had considerable authority over canal affairs, but the Barge canal law conferred new powers, the intent being so to place the responsibility for the proper conduct of the work upon this body of men, high in the government of the State and directly answerable to the people for their actions, that there could be no possibility of a repetition of former alleged abuses.

The Canal Board, although it originated many years ago, is in exact accord with present-day business methods. Great modern corporations find it advisable to have their affairs governed by a small body of men who are chosen because of their peculiar qualities of keen business acumen and sound judgment and their irreproachable characters and who are in a position to have a broad grasp of the whole business without being worried with administrative cares. In the construction and maintenance of its canals the State is engaged in a mighty business enterprise. The people of the state may be called the shareholders in this business and not only is the money they have invested at stake but the success of the enterprise means added prosperity to them as individual citizens as well as to the State as a whole. In this great State corporation the Canal Board occupies the position of Board of Directors, and the stockholders, namely, the people of the state, directly elect six members, while the seventh is the representative of the other chief elective State official, the Governor, who is not himself a member.

The wisdom of providing such sagacious and faithful oversight as this Board has given to the undertaking is seen throughout the whole course of Barge canal construction.

Upon the Governor also the Barge canal law placed more responsibility than he had formerly had in canal matters. Through a newly-created board, which was ordered to report to him, he was supposed to keep in close touch with the new canal at all times. The law laid on him the appointment of this body and it was to consist of five expert civil engineers, who were to act as an Advisory Board of Consulting Engineers and whose duty it should be to advise the State Engineer and the Superintendent of Public Works and to keep a watchful oversight on the work as it progressed.

Direct responsibility for planning and construction devolved upon the State Engineer and in order that he might have proper assistance the law gave him power to appoint a Special Deputy State Engineer and also such number of Resident Engineers as he deemed necessary, the Special Deputy to have immediate charge of the entire new work and the Resident Engineers to have charge of the several departments and sections.

The influence of some of the unfortunate circumstances attending the nine-million improvement is plainly discernible in this law. To this earlier experience may be ascribed the fuller powers of the Canal Board and the State Engineer. The new board of Consulting Engineers and through them the increased care on the part of the Governor were precautionary measures dictated by this same experience. Especially in the matter of awarding contracts and prosecuting contract work was the influence of the former project seen. New restrictions were added. The usual measures to safeguard the State were all there but their provisions had been so tightened as to make them operate with more stringent force. The thing which the law aimed chiefly to prevent was the unbalanced bid, that *bête noire* of the engineer, from which by various devices he has ever attempted to escape while yet he should retain a form of proposal and contract flexible enough to provide for emergencies. To accomplish this result the law directed that the State Engineer should make public not only the estimated quantities of each item of material or labor for any piece of work it was proposed to put under contract, but also his estimate of cost for each of these items. Then it forbade the awarding of a contract on any bid the total of which exceeded the engineer's total by more than 10 per cent or any item of which exceeded the engineer's estimated

cost of that item by more than 20 per cent, unless the State Engineer and the Canal Board should formally approve such contract. As a further precaution against an unbalanced bid a contractor in performing his work was not to be allowed to exceed in quantity any item of work more than 15 per cent without authority from the Canal Board, and this Board, if it saw fit, instead of letting the original contractor perform this work in excess of the 15 per cent might order the Superintendent of Public Works to do it or might decide to have it done by awarding a new contract.

The law ordered that all plans and specifications should be prepared by the State Engineer and approved by the Canal Board before the letting of contracts and that after the contracts were awarded these plans and specifications should be carried out without alteration except as the State Engineer and the Superintendent of Public Works should consent to and approve some alteration and a description of such alteration and such approval should be put in writing and signed by these officials and a copy filed in the office of the State Engineer. No extra or unspecified work was to be certified for payment unless such work was done pursuant to the written order of the State Engineer and no payment for this work could be made until it had been approved by the Canal Board. The form of contract to be entered into with the contractor was to have the approval of the Attorney-General. Since the records of canal transactions were open to the public the people might at all times know exactly what was being done in prosecuting the great undertaking they were being asked to approve.

There have been times during the years of construction when some of the provisions of this law have seemed to involve a useless amount of red tape, and doubtless these restrictions have been the cause of various delays, but the chief thing aimed at has been accomplished—the canal has been built and there has been no suspicion that anything connected with its construction has been other than what it should be. This condition of course is due in large part to the high character of the men charged with the duty of administering canal affairs, but in general the same may be said of some of those who had authority over the nine-million improvement but who by implication suffered unjust blame, largely because they were working under a law that contained loopholes through which the unscrupulous might escape.

Now we come to the real battle between the canal and the anti-canal forces. The preceding skirmishes had been important and were bitterly fought, but in a sense they had been only prelimi-



Dam at Delta reservoir, impounding the waters of the upper Mohawk river and the diverted Black river supply, for delivery to the Rome summit level of the canal. A portion of the Black River canal, submerged by the reservoir, was relocated, being carried across the river on an aqueduct, up the steep acclivity by a flight of locks and along the reservoir edge on high ground.

nary and the victories already won might still be turned to defeat, since the question was being submitted for final decision to the electorate of the whole state. Now the decisive conflict was on. Now the case was being tried before the court of last resort — the people — and from the plebiscite about to be given there was no appeal. It is not to be wondered at then that both sides were alive to every opportunity and that neither spared any pains to achieve its ends.

The campaign which was waged was distinctively a campaign of education. Probably no other question of economic import has ever been so carefully set before the people of the state. And yet on the day when the decision was to be made one-eighth of all the voters who went to the polls, a sixth of a million persons, failed to vote either for or against the canal proposition. But even so the proportion of those who took interest enough to cast a vote was much larger than is the case with most public questions submitted to popular referendum. Why the largest single project ever undertaken by a state should have been a matter of indifference to so many of its citizens seems strange on first thought. The reason is to be found in the popular conception of the importance of political campaigns. The majority of the people have come to look upon these as the momentous events in our political history and this view dwarfs any economic question brought to vote, even though it be of the gravest consequence.

Why this should have been a campaign of education is readily discernible. The defeat of the amendments proposed by the Constitutional Convention of 1867 was still remembered, and these had failed of approval largely because the people did not understand their provisions. The canal bill dealt with intricate and technical subjects — finance, engineering, a route largely divergent from the existing canal, adequate water-supply, a plan with novel features for letting contracts — and moreover the expenditure involved was enormous. If for no other reason the project might easily fail from lack of understanding, and canal advocates were well aware of this danger. With a powerful army of active hostility to be met and overcome, with the vast throng of the interested but uninformed to be instructed, with those in the wide, outlying regions to be convinced that the canal would benefit all, and, worst of all, with the mighty concourse of the apathetic to be quickened into life, canal men saw that their only chance for success lay in conducting a vigorous and convincing campaign of education. Naturally the opposition adopted the same tactics.

The first event we shall record in the canal campaign scarcely belongs in that category; it partakes rather of the nature of a jubilee, but there were certain results coming from this occasion which made it worthy of notice. On May 9, 1903, the Merchants' Exchange of Buffalo gave a dinner to General Francis V. Greene, Major Thomas W. Symons, John N. Scatcherd and Edward A. Bond, members of the State Committee on Canals, and to the legislators of Erie county, who had been at the forefront of the legislative contest. The dinner was attended by a large number of prominent men, chiefly from Buffalo, and speeches on the canal question were made. Its significance lies in the example set for commercial bodies in other cities throughout the state to hold similar public meetings for the discussion of canal matters; also in the trend given to arguments to be used later in gaining votes for the cause.

Canal men realized of course that they had a hard fight on their hands and they organized their forces to meet the occasion. Early in May a Canal Improvement State Committee was formed to direct the whole campaign, with headquarters in New York city. This committee was composed of Gustav H. Schwab, Henry B. Hebert and Frank Brainard of New York, John W. Fisher and Robert R. Hefford of Buffalo, Frederick O. Clarke of Oswego and Frank S. Witherbee of Port Henry. Closely associated with them and coöperating in some of the work were George Clinton, chairman of the Canal Enlargement Committee of Buffalo, and E. L. Boas, treasurer of the Canal Association of Greater New York. John A. Stewart of New York and George H. Raymond of Buffalo were appointed secretaries, Mr. Raymond taking charge of the literary bureau, to prepare and disseminate canal literature. Mr. Schwab was chosen chairman of this State Committee and he labored zealously for five months or more, so zealously indeed that toward the end of October his physician advised him to go away for a needed rest. Charles A. Schieren, ex-Mayor of Brooklyn, succeeded to the chairmanship for the remaining two weeks of the campaign and his activity put new life into the cause at a time when it was much needed.

To reach the voters this committee worked through four main channels — newspapers, printed literature, such as pamphlets and the like, speakers at public meetings, and labor unions or other organizations. The opposition carried on a campaign in much the same way.

The pro-canal endeavors were concentrated along the line of the canal and especially at its termini. The outlying territory was con-

ceded to the opposition, but, as will appear later, before the campaign ended the war was carried also into the enemies' country.

Under the State Committee Howard J. Smith of Buffalo was appointed to take charge of the newspaper work. Mr. Smith had been doing this kind of work for several years, especially during the publicity campaign of 1900-1901. He organized the new work as before and was soon supplying country weeklies with "plate" and the city papers with special articles and interviews. It is said that during the final months of the campaign plate matter was being furnished to 750 papers. To Mr. Smith personally was assigned much of the work of devising arguments for canal improvement, preparing articles, and writing and revising speeches and addresses.

The New York city press was in favor of the canal project with only two important exceptions—the *Sun* and the *Herald*. The *Sun* was unalterably opposed, keeping up a daily attack and pouring out invective, ridicule and argument in nearly every edition. Mr. Schwab tried to change the attitude of the *Herald* by cabling James Gordon Bennett in Europe and urging him to instruct its editors to support the movement, but no reply was received. The Buffalo papers were solidly with the canal men and the rest of the state was lined up just about as it had been through all the years of this agitation.

In the way of canal literature a vast amount of letters, pamphlets, leaflets and posters was distributed. The *Canal Improvement Text Book*, a pamphlet of 168 pages, was the most important in this class. It was prepared in large measure for the use of speakers and editors, but the edition was ample and it found its way to the public generally. It was a veritable storehouse of information in compact form. It contained the substance of the canal bill, considerable portions of both the State Engineer's report of the preliminary survey and the report of the State Committee on Canals, testimony of experts on the reliability of the surveys and estimates, opinions of prominent men and representative commercial organizations regarding the necessity of the canal, speeches delivered at legislative hearings, reports on the canals of certain foreign countries and numerous other bits of pertinent canal data. In addition to the *Text Book* a large edition of the *Canal Primer* was printed and distributed. This is the pamphlet which has already been mentioned as having been put out in the form of questions and answers.

A systematic effort was made to secure endorsement of the canal question by labor unions throughout the whole state. This subject

came up early in the spring, even before the bill passed the Legislature, and Warren C. Browne, then of Buffalo, was given charge of this phase of the campaign. The project was presented to nearly every labor organization in the state and was generally approved. It was a matter naturally calculated to appeal to labor unions. Even the building of the canal would give employment to many thousands through a decade or more and if expectations were realized the canal would usher in a period of industrial development in which labor might share bountifully. This work among the unions proved worth while. Their vote did much to offset adverse sentiment in the interior counties. An analysis of the vote shows that in the strongest anti-canal sections a good sized minority vote was polled wherever there were labor organizations.

Of a somewhat similar character was the attempt made to get support through the political parties. Committees conferred with the speakers bureaus of the Democratic, Republican, Citizens' Union, Socialist Labor, and Prohibition parties. The Citizens' Union agreed to have its campaign speakers advocate the canal. Another type of mass activity was the systematic work undertaken among the Italians throughout the state. This was in the efficient hands of John J. D. Trenor, a member of the New York Produce Exchange, who by reason of a long residence in Italy and a mastery of the Italian tongue was eminently fitted for the task.

Before we proceed with the remaining activities of the canal forces, which we desire to follow in a somewhat orderly chronological fashion down to the eve of the election, we shall see what the opposition was doing.

In respect to funds the opponents had a decided advantage over the canal men. They seemed never to lack money. It was charged that the railroads were back of most of the anti-canal activity and were paying the greater part if not all of the expenses.

The opposition of the large cities along the line of the canal is hard to explain. One would naturally expect them to favor the project. It is not fair to say that railroad influence and personal interests were responsible for all of this attitude. There were, doubtless, multitudes of men with no individual interests at stake who steadfastly believed that the proposed canal was not for the highest good of the State. But at the risk of being thought prejudiced we dare to assert that at bottom most of the opposition was due to some interest of a personal nature, the railroad influence predominating. And this personal interest, working through the press, molded public sentiment in various areas of the state and

thus gave to the man with no personal interest an opinion which he accepted as his own. This is not saying, however, that individual interests did not hold sway to a considerable extent also in the canal camp. But speaking by and large the canal advocates were more often actuated by altruistic motives, while the opponents were generally influenced by consideration of personal gain.

The opposition of the rural sections might naturally be expected; the same attitude had existed for years. The reasons for it, however, need not concern us now; it is sufficient to say that the organized opposition played upon this sentiment, while those of the other side did what they could to change it.

An anti-canal bureau was organized in Brooklyn, from which literature was distributed. But the center of activity was in Rochester and strangely the Chamber of Commerce of that city was at the forefront of this activity, its secretary, John M. Ives, being the director of the anti-canal forces of the state.

As a sample of the literature distributed by the opposition we may cite a pamphlet entitled, "Twenty good reasons why you should vote No," compiled under the auspices of the Rochester Chamber of Commerce. It embodied editorials from the *Engineering News*, the *New York Sun*, the *Rochester Democrat and Chronicle*, *Union and Advertiser*, *Herald* and *Post-Express*, the *Utica Press*, the *Albany Argus*, the *Syracuse Post-Standard*, the *Binghamton Leader*, the *Ithaca Journal* and several other papers, also speeches made by Senator Merton E. Lewis and ex-Assemblyman Brownell of Broome county, and articles written by John A. C. Wright, E. B. Norris, master of the State Grange, George Bullard, John M. Ives, secretary of the Rochester Chamber of Commerce, George W. Rafter, D. H. Burrell of Little Falls, and others.

An anti-canal State convention was held at Rochester and one of its chief figures was John I. Platt of Poughkeepsie. Through Mr. Platt's activities the railroad influence was plainly seen at this convention and he frankly admitted that the New York Central Railroad was paying his expenses.

On May 25 there was issued a long circular signed by sixteen State senators, who came from the farming districts of the state. In effect this was a solemn manifesto warning the people against the efforts of New York and Buffalo to carry the canal bill. That these cities were to pay for most of this improvement and were yearly paying many millions in taxes to the direct benefit of the rural communities was entirely ignored. A formal reply to this

circular was put out by the Canal Improvement State Committee on June 10.

The opposition was surely aggressive. That it was also unscrupulous in statement, both in the public press and in other literature, is charged by the advocates. If the specimen given below is a fair sample, the charge seems to be sustained. It is a handbill which was distributed at elevated railroad stations and at other places in New York city where people congregated in masses. We do not attempt to copy more than the words; the type and arrangement were such as to attract attention. It reads as follows:

"Vote, but vote No on the Barge canal scheme. Beneficiaries: Grain speculators, the contractors, the padrones. Who pays for it? You.

"This means higher taxes, direct and indirect. The latter touch everybody. Higher rents, higher licenses, heavier expenses, with no return. Vote No.

"If there is any intelligent man who thinks it will benefit the State or any section therein or any citizen thereof, save only the beneficiaries of the most stupendous graft ever suggested, let him vote for the Barge canal. If he is not a grafter and if he has any regard for his own interest let him vote No."

Comment is hardly necessary. In the case of the thinking man such literature must often have proved a boomerang. But it was not meant for him; it appealed rather to the discontented, those who were ready to see only guile and evil in others. Moreover it was a treacherous attack on the Government, an insidious implication that the State was willing to countenance "the most stupendous graft ever suggested." When we consider the motive underlying this attack and know that it was merely a cloak to cover selfish and unworthy ends, we appreciate its base character. Of such stuff are the acts which constitute the gravest menace to our American ideals. If anything like this handbill was issued by canal men, we have failed to see it. Their literature was not so sensational; a becoming dignity marked its language and its appeal was to the reason. In the end these were the tactics which won.

In the campaign program of the canal advocates the public meeting and the speakers bureau held important places. The meetings were held all through the summer and fall, increasing in number and frequency as election approached, particularly in New York city. We cannot enumerate the whole list, but shall mention some of the most prominent.

On July 28 a dinner was given in Utica under the auspices of the Canal Improvement State Committee. Some three hundred were present, business men, editors of local papers and representatives from neighboring cities and towns. Horatio Seymour, Jr., ex-State Engineer, presided, and one of the speakers was Philip W. Casler, ex-president of the State Grange. Aside from the jubilee banquet at Buffalo this was the beginning of the State-wide contest. One of the speakers called attention to the fact that it was eminently fitting that the first gun of the campaign for canal enlargement should be fired at Utica, for it was near-by, in Rome, within the same county, that the first sod was turned eighty-six years before in the construction of the original Erie canal. The influence of this dinner was felt throughout the whole immediate vicinity.

A somewhat similar conference and dinner was arranged at Syracuse for the editors of Central New York.

On August 1 a large meeting was held at Three River Point, a summer resort lying at the confluence of Oneida and Seneca rivers, which unite to form Oswego river. For years the people of the vicinity had been accustomed to hold an immense Farmers' Picnic at this place and the location was well calculated to draw a large crowd. A like meeting was held at Sylvan Beach, a summer resort at the eastern end of Oneida Lake. These two places are well known names geographically in Barge canal history, since they stand at strategic points in the line of the new canal. Incidentally it may be said that new canal construction at Three River Point has wiped out the old picnic grounds.

The various county fairs were convenient occasions for disseminating canal ideas, through both literature and public speaking. At some of these fairs Governor Odell spoke very cogently for the canal project, appealing particularly to the farmers, and as these speeches were given wide publicity they must have gained many votes.

Another form of campaigning was one that was engaged in jointly by the opposing sides — debates at public meetings. John I. Platt was the anti-canal exponent and Senator Henry W. Hill and Willis H. Tennant of Mayville were severally his opponents. Senator Hill and Mr. Platt met in debate at Troy on October 5 and both were scheduled to speak at the same meeting on one other occasion, the Wayne county fair, on October 24, but Mr. Platt and other anti-canal speakers did not keep this latter engagement. But most of the debates were between Mr. Tennant and Mr. Platt. They met at Plattsburg, Three River Point, Elmira, Utica, Cassadaga, Brocton,

Binghamton, Dunkirk, Syracuse and the Chemung county fair. This series of debates evoked considerable interest, especially in the rural districts, where little concern had been manifested before. The speeches were interspersed with anecdote and repartee, much to the amusement of the audiences. Mr. Platt was resourceful in argument, a careful student of transportation questions and a skilled debater, but Mr. Tennant was no less resourceful and well informed and in addition he had the advantage of being in closer touch with the temper and conditions of rural communities, understanding their prejudices and also what lay back of these prejudices. It is probable that on the whole these debates gained votes for the canal. It is said, for example, that there was not a single person favorable to the canal in Plattsburg before the debate, but at the election seventy votes were cast for it; also that somewhat similar results were shown in other towns.

We have had occasion to mention Mr. Platt several times. He was the most aggressive and persistent opponent of the Barge canal project during the whole course of its agitation and probably he was the most able opponent as well. Most of the adversaries were content to lay down their arms when the canal forces won at the polls, but not so Mr. Platt. He was not yet beaten. He appealed to the courts in an attempt to prove the Barge canal law unconstitutional. What was said of him during this campaign is pertinent here. "He is the avowed foe," said the *New York Times*, "not merely of canal improvement, but of canals. If he could have his way the canals would be abandoned and the railroads would get a monopoly of the transportation business. He is not a critic of the plans, nor an advocate of any particular kind of canal. All canals are equally odious to him. Nor is it the frightful sum of one hundred and one millions that scares him. If a canal 43 feet deep and 205 feet wide could be dug straight across the State from the Hudson to the Lake for a dollar and a quarter, he would sturdily oppose the project."

There was another type of debate which, perhaps, did not influence the vote of 1903 but which should be mentioned because of the impressions probably left on the minds of the youthful debaters. The canal question was well suited to academic discussion and students in many educational institutions were eager to get literature and engage in debates. And these debates carried the campaign into the territory where anti-canal feeling was most intense and where a professed advocate might not have been given a courteous hearing. The students naturally were open-minded and had

not the bias of their elders and the debates must have left some impress. Of course the influence from this source could have been only a drop in the bucket, but it is a fact that the three canal referenda submitted to the people since 1903 have been carried with but little effort on the part of canal advocates. Except for the thorough educational campaign of 1903, this could hardly have happened.

Of the remaining work throughout the state, except in New York city, little more need be given here than an enumeration of the more important meetings. The first gathering of size in the southwestern part of the state was at Lilly Dale, Chautauqua county, on August 22. In Jefferson county the campaign was opened at the Republican convention. A meeting was held in Troy in August. On September 16 a large company gathered at the Utica Chamber of Commerce and listened to speakers from both camps. At Jamestown on September 19 a meeting was addressed by a prominent leader in the State Grange, who advocated the canal side. The Tonawanda Board of Trade held a banquet for its business men, who gave attention to a speech favoring the canal scheme. On October 15 a canal meeting was held in Dunkirk. The next night at a meeting under the auspices of the Cohoes Business Men's Association the question of the effect the proposed canal would have on the water privileges at Cohoes was discussed before an interested audience. Another large meeting was held under the auspices of the Troy Chamber of Commerce on October 27. Two days later a mass meeting was attended by nearly all the prominent business men of Lockport. Of course there were many other meetings, but this list will suffice. One canal enthusiast traveled through the state delivering illustrated lectures on the benefits of water transportation and showing the need of improved channels and adequate terminals if the commerce of the state were to be retained.

But the chief battle ground in this whole campaign was New York city and in the end it was New York city that carried the day. The canal men from this city had been the first, more than two years earlier, to take a firm stand for the 1,000-ton improvement and now, when the time came for consummating their work, they all joined loyally in the stupendous task and came up to the Bronx on election night with nearly three hundred thousand votes to spare, enough, after offsetting the adverse vote of a little less than fifty thousand in the up-state section, to carry the proposition by close to a quarter

of a million majority. Lesser New York city, the old city, did even better proportionately. The vote in New York county, practically the old city, was 252,608 for and 28,979 against, or only about one opposed to the project in every ten voters.

When we recall the events of nearly a century earlier, what a commentary is this vote upon New York city's appreciation of her canal! In the light of subsequent history we cannot understand the early attitude, but when the bill to authorize the original canal was before the Legislature in 1817, every member from New York city was opposed. In the debate just preceding the vote the most masterly speaker had appealed to the members from New York, but to no avail. "If the canal is to be a shower of gold," he had said, turning to a leading member of the New York delegation, "it will fall upon New York; if a river of gold, it will flow into her lap." This became a true picture and in 1903 New York made reparation. Whatever may be one's opinion of the value of canals at the present time, he must admit that the original Erie canal was the chief factor in retaining for New York the proud title of Empire State and in making New York city the commercial metropolis of the continent. He cannot dispute this statement. The fact is too well attested; it can be demonstrated with almost mathematical precision.

New York city was well organized for the contest. The Canal Improvement State Committee, the body organized to direct this campaign of 1903 throughout the whole state, had its headquarters in New York. Here also was the Canal Association of Greater New York, which was formed early in 1900, at the beginning of agitation for a barge canal, and which had been doing yeoman's service ever since. In addition, on September 14, 1903, the canal committee of the Produce Exchange organized a Canal Improvement League, composed of fifty members of the Exchange, under the leadership of Albert Kinkle. It was through these organizations that the various interested commercial bodies and the many enthusiastic individuals in New York city labored. All through the campaign they worked, and ardently at that, but as the time of final decision drew near their efforts were multiplied many fold and the contest was closed in a whirlwind of fervor, both sides, indeed, being active to the last day.

We shall mention only the meetings of the last month of the campaign in New York city. In spite of all that had been done throughout the state, canal men were exceedingly apprehensive of the issue and an appeal was made to the New York city commercial bodies. On October 6 a dinner was given at Delmonico's by the Canal Asso-

ciation of Greater New York to the editors of the metropolitan press, forty representatives being present, as well as canal advocates from various parts of the state. The long articles in the papers as the result of this dinner and the subsequent leading editorials that appeared almost daily awakened New York city to the importance of the measure about to be voted upon.

To focus the city's aroused attention on the subject in hand these activities were followed by a very generous distribution of canal literature and a most intensive campaign of cart-tail meetings, the latter being under the management of William F. McConnell, of the Board of Trade and Transportation. Sixty speakers were engaged in this cart-tail campaign and literature was distributed at more than 1,000 mass meetings and also at all ferries and many factories.

On the same day as the press dinner, October 6, the Board of Aldermen of the city, at the solicitation of the Canal Association of Greater New York, adopted resolutions in favor of the canal project.

On October 20, under the auspices of the Canal Improvement League, there was held a mass meeting on the floor of the Produce Exchange. Among the speakers were Mayor Seth Low, two ex-Mayors of Brooklyn, Charles A. Schieren and David A. Boody, and other men prominent in business, civic and educational affairs. George B. McClellan, who became Mayor the next year and who had been invited to address the meeting but was prevented from attending by a previous engagement, sent a letter expressing his sympathy with the canal cause. The League also distributed a great number of campaign buttons and badges.

Almost on the eve of election, on October 26, the United States Supreme Court rendered its decision in the case of *Perry vs. Haines*, which held that the Erie canal, though lying wholly within New York state, by reason of connecting Lake Erie with the Hudson river forms a part of a continuous highway for interstate and foreign commerce, also that it is a navigable water of the United States as distinguished from a navigable water of the State, and that boats navigating this canal are within the contemplation of the maritime law, over which the Federal courts exercise admiralty jurisdiction.

Subsequent experience has shown that this decision has had little effect on either the practical operation of the canal or the navigation upon its waters, but coming as it did, only a week before election, the anti-canal press of the state was quick to seize upon it as a decision favoring their side, declaring that it dealt a hard blow to the State canal. In the few days thereafter there was no adequate

opportunity for canal advocates to acquaint the voters with what they considered was the true import of the decision. The anti-canal use of this decision seems to have been merely by implication rather than by definite statement of what its actual effect on the canal would be. As a specimen of this type of argument we may quote from a letter addressed to the electorate of New York city on October 29 by Andrew H. Green, advising a negative vote on the canal referendum. Without further expatiation Mr. Green simply said, "The remarkable decision of the United States Supreme Court given out yesterday, establishing admiralty jurisdiction over the Erie canal, is another formidable reason against the construction of this barge canal, the full effect of which is not yet fully realized."

The last meetings of the campaign were mass meetings held in Cooper Union on October 30 and some other mass meetings held in Brooklyn and Staten Island.

On Monday, November 2, the day before election, all of the metropolitan papers except the *Sun*, the *Herald* and the *Telegram* published a letter signed by prominent men in favor of the canal project. The men signing this letter were Seth Low, R. Fulton Cutting, Chas. A. Schieren, Gustav H. Schwab, William F. King, Robert Campbell, Thos. J. McGuire, Frank S. Witherbee, Lewis Nixon, George B. McClellan, Bird S. Coler, Oscar S. Straus, David A. Boody, Fred W. Wurster, Henry Hentz, Herman Robinson, William McCarroll and Henry B. Hebert.

There was another event occurring on the eve of election which must have had some influence on the vote. Moreover, there was that about this particular event which would lead one to suspect that it was adroitly timed by the opposition for its most advantageous entry into the canal campaign. The International Towing and Power Company had obtained permission from the Superintendent of Public Works during the summer to install a mile of track on the towing-path at Schenectady and on October 28 a public demonstration of electric propulsion was made in the presence of Governor Odell, other State officials, practical canal men, forwarders, boatmen and other men of affairs. It will be recalled that representatives of this company had appeared before the legislative canal committees the preceding winter and had proposed to equip the existing canal with their device and thus render unnecessary the 1,000-ton enlargement. In its mechanical working this demonstration was considered in general a success. The haulage was performed by means of a tractor, dubbed an "electric mule," which ran upon a slightly elevated rail.



Channel in a land-line. There are land-line sections at many localities, but the view is especially typical of much of the canal in the western part of the state, where in general the old canal was deepened and widened. A turning basin is seen in the middle distance.





First one, then two and finally four loaded boats of the maximum capacity then prevailing on the canal, 240 tons, were drawn at a rate of nearly five miles an hour, and this was done with a quick start and a notable absence of bank wash. Then two electric mules towed boats in opposite directions, showing how vessels might meet and pass when hauled by this device. The officers of the company declared that they stood ready to equip the existing canals at their own expense and to operate the system upon such terms as the State should dictate, asking the right to transfer this privilege to the new canal when completed. The Superintendent of Public Works was inclined to regard the proposition favorably, but consent was withheld for the time being.

The anti-canal press was quick to exploit this event also, stating that the demonstration proved the utter uselessness of expending the vast sum contemplated by the referendum. In this instance too there was not time for the canal men to attempt a refutation of the claims made by their adversaries.

There are several reasons for suspecting that anti-canal influence was back of this demonstration. We are not attempting to argue the case but simply to point out certain peculiar facts, in order that the reader may understand the significance of the event. The most conspicuous experiments in electric propulsion on the State canals have been made in 1895 and 1903 and in each instance they have occurred only a few days before the people were to vote on a referendum for canal improvement and each experiment has ended with the demonstration made just prior to election. The time of making such experiments public, within two or three days of election, is in itself suspicious, even if nothing else were. It may be well to add that some steel construction experts of the State Engineer's department saw the trial in 1903 and their computations showed the avowed cost of installing the system claimed by the company to be many times too small.

The result of the election we have already seen. To the enthusiasm, the unremitting labor and the generosity of its canal advocates the State of New York is indebted for its modernized waterway. And the canal forces, by the way, had but a pittance to carry on their campaign and almost all they had was raised by voluntary contributions from private individuals, people who generally had no financial interests at stake.

We have not attempted to burden the narrative of the Barge canal agitation with a multitude of the names of those who were respon-

sible in various ways for its successful fruition. We have been content to mention a few now and then and perhaps we have not always been fortunate in our selection and have failed to include those to whom much credit is due. But of course fuller lists are to be had; they may be found in the legislative journals, in the minutes of State waterway and other conventions and in various other chronicles. We would refer the reader especially to two large volumes of the *Buffalo Historical Society Publications*, Volumes XII and XIII, which are made up entirely of canal papers and devote the major portions of their pages to the history of this particular time.

But before we enter upon the period of actual canal planning and construction we desire to quote a few paragraphs from a writer in one of these volumes, in which he enumerates a half dozen critical periods of this time and gives the name of the man who was found for each emergency. The article was written by George H. Raymond, secretary of the Canal Improvement State Committee, and the portion we quote runs as follows:

"In a chronicle of this kind it is impossible to give proper credit to all of those entitled to it, as each canal friend did his best in his own manner; but there are certain critical times that stand out in bold relief when it can be clearly shown that the right man was found at the right time to save the canal system of the State.

"To the Honorable George Clinton is due the credit for keeping the canal spirit alive when as a member of the Assembly he secured an appropriation for lengthening one lock on the Erie canal.

"To the Honorable Henry W. Hill of Buffalo is due the credit of saving the canals, when, after a most bitter struggle in the Constitutional Convention of 1894, to which he was a delegate, he succeeded in putting in the clause prohibiting their sale and abandonment.

"To the Honorable Thomas C. Platt of New York is due the credit of saving the canals when he forced the Committee on Rules of the Assembly in 1900-'01 to report out the bill appropriating \$200,000 for the survey and estimates which finally made the 1,000-ton barge canal possible.

"To the late lamented Alfred Haines of Buffalo is due especial credit for the final successful result of the great canal struggle as he, almost alone, raised the funds that made it possible to carry on the educational campaign which finally brought the barge canal plan to a successful vote.

"To the Honorable George Clinton is again due especial credit for his marvellous diplomacy in keeping the canal friends in Buffalo and New York from allying themselves with the Democratic party in 1902, as its defeat, which occurred, would have killed all future efforts, as the Republican leaders were not friendly to the project and would have been able to say that the canal people and the Democrats were both defeated at that election.

"To the late Honorable Timothy Ellsworth of Lockport is due especial credit for the brilliant *coup* made by him, assisted by the Honorable Thomas F. Grady of New York, when he brought the \$200,000 canal survey bill of 1900 out of the finance committee which with the Honorable Frank Higgins, afterward Governor, as chairman, had a majority opposed to the bill. No more brilliant parliamentary battle was ever fought or more gallantly won than this by Senator Ellsworth."

No canal history would be complete without the mention of another name — a man interested especially in the canals of New York, his own State, but also well known up and down the whole Atlantic coast wherever canal projects were being agitated — the most persistent advocate of them all, unflagging in his zeal both in season and out of season; not always with good judgment, to be sure, and often to the annoyance of unwilling listeners or men busy with other affairs; somewhat disappointed and acrimonious, perhaps, when he discovered that the Barge canal had so changed conditions that the old-time boatman had no place upon it; but now that those days of vexation are passed, one who will be remembered as the man to whom canals were a consuming passion — William C. Clark. We would quote concerning this man from another writer in this same volume of the *Buffalo Historical Society Publications*.

"Previous to 1894," says Mr. M. M. Wilner, of the editorial staff of the *Buffalo Express*, "the defense of canal interests was left largely to the boatmen themselves. Captain 'Bill' Clark of Constantia was the chief press agent. He wrote his name 'Captain W. C. Clark,' but it should properly go into canal history as 'Bill,' since that was what everybody called him. It was Captain 'Bill's' chief business in life to travel up and down the State, calling at the newspaper offices and keeping them informed on the needs of the canal from the boatmen's viewpoint. He haunted the Capitol during legislative sessions; he hung around the hotels at all State conventions; everybody laughed at him; no one paid much attention to him. But there was really quite an important political power back of the

quaint old agitator. He claimed to represent and, in a sense, did represent the votes of the boatmen. There were at that time over 4,000 canal boats in use. Estimating that each boat represented five voters, the managing politicians could easily see that here was a force which could not be antagonized without some danger. There was, of course, a great business element in the State supporting the canal also, but it was the voice of the organized boatmen which was most in evidence among the newspapers and politicians in those years."

It may be added that probably Captain Clark's chief claim to gratitude lies in his activities in trying to keep the waterway question a live issue during the days when the outlook for the New York canals was darkest, the days when the pendulum of public unfriendliness had swung to the extreme of disparagement and most of the lateral branches were abandoned, the interval before the first of the modern advocates rose up and brought about the beginning of the series of improvements that have continued down to the present time.

CHAPTER VII

EARLY POLICIES AND METHODS

Period of Engineering Prominence—Rank of Barge Canal as an Engineering Feat—Engineering Problems the Results of Social, Economic or Industrial Questions—Project Started Expeditionily but Cautiously—Construction an Enormous Task—The year 1904 One of Manifold and Far-Reaching Activities—Advisory Board of Consulting Engineers Appointed—Mr. Van Alstyne succeeds Mr. Bond as State Engineer—Standard Specifications Carefully Prepared—Radical Change in Classification of Excavated Material—Boat Design to Prove Canal Capacity—Test Contracts to Ascertain Probable Total Cost—Characteristics of Test Sections—First Bids Show Prospective Saving—Lump Sum and Itemized Bids Asked at First Letting—Question Raised as to Concrete or Stone Masonry—Investigations and Report on Masonry Practice in Middle West and South—Studies for Making Changes in Canal Route: Tonawanda-Lockport Level: Lockport-Rochester Level: At Medina: Genesee River Crossing: At Rome: At Utica: Waterford Land Line—Study for Movable Dams—Study Extended to Europe—Bridge Type of Dam Adopted—Study for Changing Route near Savannah—A Longer Change and Enlargement of Cayuga and Seneca Canal Involved—Survey to Cayuga Lake Made—Influence of Cayuga and Seneca Agitation on Main Line Change—Route Changed by Legislative Amendment, Fox Ridge to Macedon—Another Amendment Allows Change of Lock Dimensions—Lock Dimensions Fixed—Provision for Future Channel Widening—Study for Securing Federal Aid, Troy to Waterford—Numerous Findings of Study—Advisory Board to Continue During Construction—Terminals Suggested—Certain Bridges Changed to Bascule Type.

THROUGH many pages we have been considering the affairs in which the canal advocate and the legislator played the major parts. We come now to the time when the engineer had his day, and a rather long day it has been as time is measured, but to the historian who would make his recital something more than a record of technical achievements, however absorbing that may be to the engineer, this whole period seems somewhat lacking in outstanding events or in matters of any wide-spread popular interest. To make this chapter more interesting the topics discussed are confined chiefly to those which concern policies adopted or methods pursued.

Chronologically we have now nearly reached the period of canal construction, but the present chapter, as has just been said, does not deal with that phase of the undertaking. It has seemed best to

segregate the events or subjects which have to do mainly with the actual work of construction and place them in chronological order in a chapter by themselves. To do this logically two other chapters besides the present must intervene, since construction on the Erie, Champlain and Oswego canals and on the Cayuga and Seneca canal after that branch was included and then on the terminals after they were added was all progressing at the same time, and a description of building operations on the parts added to the project would be out of place until after the accounts of their inception.

The average engineer is not much in the public eye. He is engrossed in his own work and takes his delight chiefly in knowing that he has solved difficult problems and accomplished great deeds, not caring much what others, aside from his brother engineers, may know or think. The average engineering problem also, like the engineer, is not much in the public eye. Perhaps from its technical character this is necessarily so. Possibly too the engineer's attitude may have something to do with it. If he took the public more into his confidence, doubtless many persons would show greater interest in engineering attainments and deeper appreciation of their importance.

As an engineering project the Barge canal ranks at the top of the world's accomplishments. Its contemporaneous undertaking, the Panama canal, has overshadowed it in public esteem, especially in America, but we have no hesitancy in saying that, because of its more numerous and multifarious structures, its problems, much greater in number and more difficult, its greater length, and its construction through a highly developed and populous territory amid the restrictions of public and private commercial interests, vested rights and legal entanglements — because of these characteristics and conditions, we have no hesitancy in saying that the engineering world in general ascribes to the Barge canal a higher technical rank than to the Panama canal. Foreign engineers surely recognize the standing of the Barge canal and many have been their pilgrimages to view it, some choosing to see its structures in preference to visiting the Isthmian waterway.

Since the Barge canal has this engineering side as well as its commercial, economic and political sides, and since the engineering aspect occupies so conspicuous a position and constitutes so much of the canal history, we feel that, as we proceed with the account of canal construction, we must from time to time enter upon the discussion of a few strictly engineering features. We need not go deeply into technicalities — a volume of plans dealing exclusively with this phase

of the subject has recently been published — but to understand why various policies have been adopted we must know something of the engineering problems that have dictated them.

Then, too, since the engineering problems were so closely connected with, or perhaps it would be better to say, were the results of various social, economic or industrial questions, we view them not merely as technical achievements but as explanations of certain phases of growth and development. Thus at the very beginning of Barge canal planning we shall see how the question of using concrete for its large structures was involved in the life of certain labor organizations and evidenced the passing of a long-established trade; how the adoption of movable dams affected the welfare of riverside communities and indicated an important advance in engineering knowledge; how a proposed betterment prevented interference with the business interests of a thriving village and eventually, together with other causes, added a new branch to the enlarged canal system; how the widening of locks put the State in position better to cope with its rival, Canada; how a study of canalizing the Hudson brought Federal aid; how a new provision in the specifications tended toward the attainment of justice and the elimination of fraud; how deviations of route affected such localities as Rochester, Rome, Utica and other places; and later we shall see how on the question of terminals hung the success of the whole canal and also much of the prosperity of the State.

Perhaps it has been noticed that in the preceding pages we have been rather chary in using the term Barge canal. Up to the time when the people authorized a particular type of canal there were various schemes of improvement which were under consideration and in treating of that period it seemed wiser to use as distinctive terms as possible; the phrase 1,000-ton canal appeared better to describe the main project. But hereafter we may use the term Barge canal and feel certain of not being misunderstood. As a matter of fact the name had come into popular use long before the time we have mentioned. Since it has come now to be the accepted appellation of one particular canal system, we shall use a capital letter in spelling it. Moreover, we shall employ the term often according to a very common use — as a generic title — to include all four of the separate branches of the system.

We have seen something of the intense feeling that had been aroused on both sides in the contest for the Barge canal. But now that the people had ordered its building they expected that the work

would be pushed to completion as soon as possible. It was needful, therefore, for those in authority to advance with speed but with extreme caution withal. The defeated opponents, as well as plenty of the friends also for that matter, were only too ready to condemn if aught went wrong. Then too there was the memory of the nine-million experience fresh in the minds of everybody. The State Engineer appreciated the temper of the people and began his work within a very few days after the official count of the vote. The State Board of Canvassers does not meet until a little before the middle of December, but by the fifteenth of that month the engineers had begun their operations and soon afterward plans for a carefully-organized engineering force were being carried out.

The task imposed by the people, that of building the Barge canal, was gigantic; how vast an amount of labor it has involved can be realized only by those who have been through the whole of it. And the chief burden rested on the State Engineer, the major portion of all the labor and of the responsibility also devolving upon him. His was the duty of making the plans and then of seeing that the work of construction was done properly and in accordance with those plans; his was the task of gathering all necessary information, drawing conclusions from the data in hand, deciding what to do, and then going ahead and doing it. To be sure there were the Canal Board and various officials who in a way shared that burden, but the work was mainly one of engineering and naturally most of the questions that arose fell to the lot of the State Engineer, and so it was that others in authority were guided by and placed chief dependence upon his opinion; moreover, if anything had gone amiss he would have had to bear the blame. He had able counselors, however, in the members of the Advisory Board and he was privileged to employ a number of expert assistants.

If the average engineer is not greatly concerned with public acclaim, neither is he prone to make much ado about his difficulties, regarding them simply as part of his day's work. So with the project we are studying. Little was said to let people know that it rivaled the world's greatest deeds, that some untrodden fields were being entered, that the safety of cities and villages and the lives of their citizens depended on the proper planning of structures, that untold watchfulness was constantly necessary to guard the State's interests, or that a hundred and one troublesome problems were daily crying for solution.

Although the engineers had begun their work by December 15, 1903, it was not until the spring of 1905 that the first contracts were awarded and the work of construction actually commenced. But the year 1904 was not one of idleness, far from it. In spite of all the preliminary examinations, much additional information had to be acquired and new surveys of practically the whole line of the canal had to be made. An organization to endure for a decade or more and suited to handle an unusually large enterprise had to be perfected. Rules and instructions for conducting all the many kinds of work had to be formulated. And in all the contract plans made, not only in that year but also in the next year or two, the whole project had to be considered, since these first contracts were setting precedents and fixing standards.

As one reviews the records of that first year of canal planning, the feature which stands out preëminent amid the manifold activities is the painstaking care and thoroughness with which the project was undertaken. With so enormous an enterprise in prospect no one could afford to make mistakes at the beginning. The nine-foot deepening was a lamentable example of work rushed into without due forethought or sufficient preparation and its warning was being heeded.

On March 3, 1904, Governor Odell, under the authority given him by the Barge canal law, appointed "five expert civil engineers to act as an Advisory Board of Consulting Engineers." These were, Edward A. Bond, William A. Brackenridge, Dr. Elmer L. Corthell, Commander Alfred Brooks Fry and Col. Thomas W. Symons. We have already mentioned Mr. Bond and Col. Symons many times. Mr. Bond had then entered upon his sixth year as State Engineer. The other three were well-known engineers. Mr. Brackenridge had had large experience in water-power installation, Dr. Corthell enjoyed an international reputation and Commander Fry had been prominent in Government service.

By reason of Mr. Bond's new position as chairman of the Advisory Board and his subsequent resignation as State Engineer the latter office became vacant. On May 10 the Governor appointed Henry A. Van Alstyne to fill out the unexpired term as State Engineer. Mr. Van Alstyne had been serving as Division Engineer on the Eastern Division for about three years and before that had been Assistant Engineer and Resident Engineer for several years and was well acquainted with State engineering work. Two days later the new State Engineer appointed Henry C. Allen to be

Special Deputy State Engineer, the office created by the Barge canal law for supplying an engineer who should have direct charge of the whole Barge canal project. Mr. Van Alstyne served as State Engineer till January 1, 1907, being elected in the fall of 1904 for a regular term of two years, and upon him and his Special Deputy, Mr. Allen, rested the responsibility of Barge canal operations until 1907. For the five months of work up to Mr. Allen's appointment William B. Landreth, Resident Engineer of the Eastern Division, had been in charge under the State Engineer.

The care attending the Barge canal work, especially the early stages of it, is seen particularly in the specifications. Any contract of course has its own individual specifications, but the large majority of items are common to many contracts and can be put in standard form, and it was these standard specifications that were then engaging the thoughts of the engineers. After their preparation by the State Engineer's corps these specifications were submitted to both the Advisory Board and the Canal Board and there subjected to careful revision. Upon points involving any legal questions the Attorney-General's suggestions were followed. No efforts were spared to make the specifications as clearly understandable and as perfect as possible. There were some departures from the practices theretofore prevailing on State work, notably the classification of excavated material. This was a very important and somewhat radical change and one that resulted from certain experiences we noted in our earlier study of the subject. The new specifications required all excavation of whatever nature to be done under one classification and for one price. This arrangement probably did not result in any financial advantage to the State, but it did militate toward the minimizing of trouble, for it is through differences of opinion as to the proper classification of excavated materials, when a specification makes provision for classification, that the most serious controversies on contract work arise and the chief opportunity for wrong-doing is presented. It was largely this difference in the specifications of the nine-million improvement that laid that whole project open to the charge of fraud. State Engineer Van Alstyne believed that by the elimination of every question relative to classification the greatest obstacle to a successful and clean administration of the work had been removed. To offset the element of uncertainty in this method of procedure careful borings were made upon the sites of contracts, a knowledge of the probable character of materials being thus obtained and the records of these tests and

the samples taken in the borings being kept and exhibited to prospective bidders.

In another matter the State Engineer showed the care with which he was proceeding. In all the preliminary studies it had been assumed that a barge of 1,000 tons capacity could be accommodated in the locks which it was planned to build, but no detailed plans for such a boat had actually been made. In order to determine definitely the size and capacity of barges suitable for use in the prism and locks of the proposed new canal Mr. Van Alstyne obtained the services of Horace See, a naval architect of New York city, and requested him to design a barge and compute its carrying capacity. According to Mr. See's plans and accompanying report it appeared that a barge 150 feet long and 27 feet beam, when loaded to 10 feet draft, had a cargo capacity of 1,020 tons and that a power barge of like dimensions could carry 892 tons. As the law fixed the lock dimensions at 328 feet between hollow quoins and 28 feet clear width, it can readily be seen that a 1,000-ton barge could navigate the new canal and also that two such barges could be passed at one lockage.

One of the chief arguments directed against the proposed canal in the campaign which was just ended had been that the estimates were not reliable and that the project could not be completed within the sum appropriated. With this possibility in mind State Engineer Van Alstyne determined to ascertain with a fair degree of accuracy the probable cost of the whole improvement and for this purpose he selected eight sections of canal, well scattered over the whole state, each of which was typical of a particular class of work and all together embracing nearly all classes that would be encountered. Proposals from contractors for the work on these sections might reasonably be supposed to be a good index of the total cost.

Briefly we may enumerate these eight sections and describe the kind of work required at each locality. First there was the improvement of the Champlain canal from Northumberland to Fort Edward. Here there were a river channel and a land line prism to excavate and a dam, a lock and a guard-gate to build. The excavation was in soft rock and earth, both in the dry and under water, and besides the concrete structures there was timber work in docks and cribs. Two large locks at the Eastern end of the Erie canal constituted the second selection—locks of the highest lift ever undertaken in the world at that time, embodying a great volume of concrete and requiring a large amount of earth and rock excavation in preparation. The third section embraced five miles of canal

just east of Oneida lake, where a channel was to be dug through fine sand, suitable for a hydraulic dredge to handle, and several steel bridges and a breakwater into the lake were to be built. The fourth project contained material also suitable for a hydraulic dredge, the silt, marl and sand in six miles of canal across the Montezuma marshes. The fifth section included four miles of canal near Rochester, where there were a million and a half yards of hard rock to be excavated. For the sixth proposition there was chosen the enlarging of six miles of existing canal near Medina, typical of a long stretch of canal in the western part of the state, where earth and rock must be excavated during the winter season and minor structures were to be erected. The seventh selection was the improvement of Tonawanda creek, which was to be widened and deepened through soft, wet soil. The eighth section was located in the city of Fulton on the Oswego canal. Here there were existing river dams to be raised, two locks to be constructed, rock to be excavated under water and structures to be built in the readjustment of private water-power interests. It may be said parenthetically that this eighth section, because of both natural obstacles and difficulties with the contractors, proved one of the most troublesome on the whole canal.

Before the year 1904 was gone contract plans had been prepared for the first five of the propositions we have just listed. These were contracts Nos. 1 to 6, inclusive, the first proposition having been divided into two contracts. On December 15, 16 and 17 proposals were received for these six pieces of work. The sum of the lowest bids amounted to \$4,242,620. The appropriation carried by the law authorizing the canal, it will be remembered, was based on the State Engineer's revised estimate of 1903. The 1903 figures for the work included in these six contracts showed a total of \$5,015,883. This was a prospective saving of \$773,263, or 15.4 per cent. Since nearly all classes of work were embraced in these contracts and since the tenders were received from a large number of contractors, hailing from many parts of the country, the result of this initial opening of bids was looked upon by those in authority as a most favorable indication that the whole canal could be built well within the appropriation.

There was one fact connected with these bids which we should notice, since it would have been a radical innovation if it had gone through as planned and moreover it accounts for the delay in awarding these first contracts. By resolution the Canal Board had directed that each bidder be asked to state a lump sum for which he would

do the entire work embraced within the contract, in addition to submitting a bid composed of unit prices for the various items of work. As introduced this resolution made it obligatory on the bidder to submit both forms of proposal, but before passing the Board it was amended and merely requested both lump sum and itemized bids. When these first tenders were opened there appeared only two lump sum bids on each of three contracts and in all cases the lump sum bids were higher than the lowest of the itemized proposals.

The legality of this procedure was seriously brought into question. The Barge canal law, it appeared, was silent in regard to receiving alternative proposals, but what was known as the general canal law (chapter 13 of the General Laws) forbade such bids, imposing upon anybody submitting more than one proposal on a single contract the penalty of rejecting all his bids. The task of awarding Barge canal contracts devolved by law upon the Superintendent of Public Works. The incumbent of the office at that time, Charles S. Boyd, felt it his duty to submit this question of legality to the Attorney-General, and also, since his term of office was about to end, he deemed it proper to leave the whole subject, including the award of contracts, to his successor. The outcome of this matter is told in the chapter on canal construction.

Early in Barge canal operations the engineers were called upon to decide a question which at that time loomed rather large—whether concrete or stone masonry should be used in the new structures. This necessity arose, not because the engineers themselves doubted the wisdom of using concrete, as had been planned in the preliminary estimates, but because various interested labor organizations protested against its use. Delegates from these associations, representing stone-cutters, bricklayers and masons, appeared before both the Canal Board and the Advisory Board, praying for the substitution of stone masonry. Up to that time the State had not employed concrete to any great extent and indeed concrete had not yet taken its present place in general use.

In the history of industrial development there has come many a time when some radical improvement has wiped out a whole trade and always the artisans of such handicraft have striven against the innovation. So it was now. Perhaps the members of these trades did not perceive the ultimate futility of their struggle, but they could see that such an enterprise as the Barge canal would abundantly lengthen the days of their occupation. It was the very largeness of the Barge canal project which precipitated the crisis at

this time. Canal authorities appreciated the gravity of the situation and took considerable pains to show the wisdom of their choice.

With some show of reason the petitioners pointed to two conspicuous failures of large concrete structures in the state and they contended also that climatic conditions in New York were inimical to the successful use of this material. Although New York State had not employed concrete much, its use on Federal works and in other parts of the country was becoming general practice. To ascertain the condition of these structures from personal inspection and also to advise with prominent engineers who were becoming expert in using concrete, William B. Landreth, who was then serving as Engineer-Secretary to the Advisory Board, made a trip through the Middle West and South in August, 1904. He went into Illinois, Wisconsin, Minnesota, Missouri, Kentucky, West Virginia and Pennsylvania, examining large works of concrete and conferring with engineers. The conclusions he arrived at, which were concurred in by the Advisory Board, are worth noting, since they effectually decided the question for the Barge canal.

"The conclusions reached by me," said Mr. Landreth in his written report, "after an examination of the various works and from conversations with the several engineers are as follows:

"1. That concrete built of proper materials, well selected and carefully placed, has proved as strong and durable as cut-stone masonry.

"2. That its use in locks, dams, retaining walls, bridge piers and abutments, and in fact in all places where cut-stone masonry was formerly used, is becoming universal.

"3. That the cost of concrete masonry is from one-fourth to one-third that of cut stone.

"4. That work can be built of concrete much more expeditiously than of cut stone, owing to the great difficulty in preparing the stone as rapidly as needed in the work."

The examination extended as far north as Duluth, which is 275 miles farther north than the Erie canal and experiences much more severe winters than New York state. The estimated cost of substituting stone masonry for concrete in the Barge canal structures amounted to \$16,100,432 and this fact also had its due weight in deciding the issue.

The preliminary survey for the Barge canal had been conducted with as much care as was possible in the time available and on its results the general line of the canal and many details of construction had been definitely fixed for insertion in the law authorizing the

work. Only within somewhat narrow limitations could the State Engineer or the Canal Board make any changes. By this means the framers of the law had sought to protect the State against the peradventure of undue expenditures or unscrupulous acts. But early in the studies for contract plans it appeared that by more extended investigations several possibilities of betterment might be found. We shall look at some of these studies. A few of them led to ultimate changes from the original plans, some without the necessity of amending the law and others by means of amendments.

Beginning at the western end of the Erie canal the first place for such improvement was the Tonawanda-Lockport level. Then proceeding east there were the Lockport-Rochester level, the gorge at Medina, the crossing of the Genesee river, the alignment near Savannah, the locations at Rome and Utica and the passage between the Hudson and Mohawk rivers. These studies all came in the first year's examinations. Going a little more into detail we learn that the change on the Tonawanda-Lockport level was one of altered elevation, lowering the level about four feet by doing away with a dam, thereby eliminating a lock and the feeder from Black Rock. The question on the 63-mile Lockport-Rochester level was also one of elevation. By raising this level three feet at Rochester and a little more than five feet (providing for surface slope) at Lockport a large saving in expense could be made. The gorge at Medina furnished one of the most interesting engineering problems on the whole line of the canal. Although its solution was attacked early in the first year, the construction here formed one of the last large contracts to be let. Upwards of a dozen separate sets of plans and estimates were made before the final scheme was reached. The possibility of avoiding a very objectionable loop by carrying the canal over the 400-foot gorge, 100 feet above its bottom, presented a very fertile field for investigation. We shall speak of these plans later. A consideration of the Genesee river crossing suggested the substitution of a movable for a fixed dam. Here was another location prolific of extended study. Because of its manifold problems and the difficulty of reaching agreements with the people of Rochester this was the last portion of the canal to be completed. We shall have occasion to speak often of the work in this vicinity. The possibility of a new alignment near Savannah became involved subsequently in the question of adding the Cayuga and Seneca canal to the Barge canal system; its discussion will be reserved to a later time. At Rome the canal problem was intricately complicated by

the railroads and much time and labor were needed for its solution, as we shall see later. Just prior to the adoption of the Barge canal project the city of Utica had begun a straightening of the Mohawk river north of the city in an attempt to regulate the stream. Now the people wanted the canal alignment changed by shifting it to the north, farther away from the city, so as to utilize the new channel. After careful consideration the State Engineer agreed to this idea and began his plans in accordance with it, but construction did not begin till five years later and by that time new elements had entered into the problem and had thrown the alignment still farther north, almost to the edge of the valley. Near the eastern end of the Erie canal there is an almost abrupt descent of considerable height into the Hudson river valley. The Mohawk makes this drop over the Cohoes falls. The old Erie canal made it by means of its "sixteens," that trial of the old canaler, sixteen locks in close proximity. The original Erie canal made a partial failure of its attempt to pass this declivity, the locks being so near together that frequent lockages drained the short levels between the locks and grounded the boats, and during those early days the lockages were frequent, for the traffic was large and the boats were small and they were plying on the canal in vast numbers. The territory in the vicinity of the falls had been frequently surveyed but not until the studies of 1904 did it occur to anybody to utilize a natural depression that extended a good part of the way between the Hudson and the Mohawk. The new location at once commended itself and was speedily adopted. Along this stretch of about two miles and a half there has been constructed a section of canal which is abounding in features of especial interest to the engineer, the main attraction being the greatest series of high lift locks in the world, five locks elevating boats through a height of 169 feet.

Another study that was begun in 1904 resulted in substituting dams of the movable type in the Mohawk and eventually at two other localities for the timber, rock-filled dams of fixed type as originally planned. This was a question which involved more than engineering problems; it was one which at certain critical periods vitally affected the well-being of the communities along the Mohawk. Because of its remarkable endowment by Nature to become the principal thoroughfare between the Atlantic coast and the interior of the continent, the valley of the Mohawk has become a well-populated region and one of high commercial development. This was the avenue of travel and transport used by the Indian long before the coming of the European. This was the route along



Movable dam of bridge type, beside a lock — at Scotia, on the Mohawk river. Eight dams of this type used in canalizing the lower Mohawk; three used elsewhere — at Herkimer, Mays Point and Rochester. Structures shown in this view were built on pneumatic caisson foundations.

which the white man established his trading posts, that later grew into hamlets, and here he made his first attempt to open water communication with the great inland lakes. The original Erie canal turned these hamlets and lonely frontier cabins into thriving cities and flourishing villages and soon the railways came to increase the prosperity, so that today the Mohawk is lined with valuable farm, village or city property, where is heard the hum of industry, and each bank of the river carries its great railroad. Any change which might increase the height or the frequency of floods in a territory like this was a menace to life and property and a grave hindrance to successful business, and such menace the fixed dam would have been.

The fixed dam, the dam of all the past ages, as unchangeable as the centuries it has served, holds back its water to a minimum level at all times and functions well during the normal stages of a stream, but in periods of flood its presence may be decidedly objectionable. The movable dam, on the other hand, as its name implies, may be removed from a stream as occasion requires. This type of dam appeared first about ninety years ago, has been devised in many forms, and either is built in sections which in the form of gates, wickets or smaller "needles," as they are termed, may severally be raised above the water-surface or be entirely removed, or is constructed as a crest that by some means may be lowered into a recess below the bed of the stream.

During 1904 the studies of the Mohawk river had led to the conclusion that some form of movable dam must be adopted for the successful canalization of the stream, but what type to use did not then appear. By this means it would be possible to control floods and ice outflows to the extent at least of restoring natural conditions. Complete flood control, however, requires more than such regulating dam — reservoir storage chiefly. But these dams would help to keep the river from being the "ungovernable thing" of which Benjamin Franklin wrote and tend to make it "quiet and manageable."

A little later the study of movable dams was undertaken with more care, with the view to determine definitely what kind to use. A man who had had considerable experience in such work, David A. Watt, was secured to supervise the making of plans, and existing movable dams were inspected in both America and Europe. Mr. Watt visited in Europe canal structures on the lower and upper Seine, the Yonne, the Marne, the Oise, the Saône, the Rhone, the Po, the Danube, the Moldau, the Elbe, the Spree, the Main, the

Ems, the Rhine and the Thames. Not only were movable dams inspected but whatever information was available that seemed applicable to the Barge canal Mr. Watt brought back with him.

The style of dam adopted was known as the bridge type with Boulé gates. This seemed best to satisfy the prime requisites — certainty and simplicity of operation. A good example of this kind had been found at Mirowicz, Bohemia, on the Moldau river, a dam completed in 1904.

These dams, as they now appear in the Mohawk, seem to be bridges with abutments and piers. From the downstream side of the lower chord hang steel frames with heavy upright pieces 15 feet apart, upon which slide an upper and a lower tier of large rectangular steel plates, called gates. When serving as a dam the bottoms of the lower gates rest on a concrete sill in the river bed, the tops of the upper gates forming the crest of the dam. When more water is to be passed one or more of the upper gates are partly or wholly raised. When all the water is to be passed, in extreme flood or during the winter, all the gates are raised and both gates and frames, which have a pin joint connection with the chord, are swung to a horizontal position under the bridge floor.

At the time of making the 1900 preliminary survey two routes were considered in the vicinity of Savannah. This village stands on what is known as Crusoe island, which is not an island at all but is high, hard land, several miles in circumference, surrounded by low, marshy land. The route chosen crossed this so-called island and was direct but it necessitated deep excavation and passed through the business portion of Savannah, cutting the village off from railroad communication except by a bridge upon the main street and doing considerable damage to property. The route circling the northerly end of the island was a mile and a quarter longer but was much cheaper. The original Barge canal law distinctly prescribed the course of the canal at this point. In his annual report for 1904, however, State Engineer Van Alstyne again raised the question, summing it up in this manner, "Is it worth \$250,000 to save twenty-five minutes of the time required to make a trip from Buffalo to Albany?" The law was explicit in stipulating the reasons for which the State Engineer might make changes in canal alignment and it was conceded that this case did not come under the provision. But it is doubtful if a change would have been made here, had not a new question entered into the consideration — two new questions in fact, one embracing an alteration in alignment

of much wider scope and the other involving nothing less than the addition of another canal, the Cayuga and Seneca, to the Barge system. In the final solution the line of the canal for many miles in this vicinity was pushed away to the south, far from Savannah or its environs.

One of the laws of 1905 (chapter 700) directed the State Engineer to survey for a canal between the Barge canal and Cayuga lake. Back in 1900 the State Committee on Canals had recommended that the Cayuga and Seneca and the Black River canals be retained as navigable feeders but not enlarged and all through the agitation this suggestion had been followed and these two canals had been kept out of the discussion. But now, before construction had more than begun, came this first move toward adding another branch to the system, the Cayuga and Seneca canal. Later there were more or less serious attempts to make nine other additions, these being the abandoned Chemung canal, an extension of the Black River canal, the Glens Falls feeder, a branch from the Seneca river to Auburn, a section from Tonawanda to Buffalo and canals between Flushing bay and Jamaica bay, Newtown creek and Flushing bay, Gravesend bay and Jamaica bay, and Jamaica bay and Peconic bay. Of all the proposed additions to the original Barge canal system, however, only that of the Cayuga and Seneca canal has been effected and this was not accomplished until 1909. We are not at present directly concerned with this new branch but rather with the change made in the Erie canal in anticipation of its eventual inclusion.

In reporting on the survey to Cayuga lake State Engineer Van Alstyne said that the question had arisen in this connection whether by changing the route of the main canal, bringing it closer to Cayuga lake, a location better in some respects than the one chosen might not result and at the same time provision be made for a cheaper connection with Cayuga and Seneca lakes. This proposed change in alignment was of considerable length, from Fox Ridge to Lyons, nearly twenty-five miles by the new line, some eight miles more than by the old line, but it lay largely in river channels, where the cost of both construction and maintenance would be lessened, where the wider channel would give increased safety and ease to navigation and where seepage and the consequent damage to adjacent property would be minimized and all the water-supply of the region would become available. These and other advantages were such as to cause the continuation of the study on this subject until

plans had been sufficiently developed along both lines to know of a certainty the good points and the cost of each.

The movement to provide for a direct connection between the Barge canal and the Cayuga and Seneca canal had a marked effect in deciding the question of altering the alignment of the trunk line. The people of the Cayuga and Seneca valleys were getting back of the agitation and bringing strong arguments to reinforce their claims. Unless conditions were changed the only connection with the Cayuga and Seneca branch after the new canal should be completed would be by way of the existing Erie canal from Montezuma to Syracuse and thence down the existing Oswego canal to its junction with the Seneca river a little below the foot of Onondaga lake. But the details of the survey of 1905 need not be given till the addition of the Cayuga and Seneca canal is discussed as a distinct project. This survey, it will be noticed, contemplated a spur only to Cayuga lake. The scheme for enlarging the whole extent of the Cayuga and Seneca canal did not develop until later.

The problem of a new course for the Erie canal, however, advanced steadily to a final solution. On January 15, 1906, the Advisory Board had held a public hearing on the question, attended by representatives from a full dozen commercial bodies and canal organizations. In this manner the sentiment of business and canal interests was obtained and in general it proved favorable to the change, but Savannah objected. Although the new arrangement would avoid injuring the town it would take the canal entirely away and quite naturally the people preferred the canal and its benefits to a few slight inconveniences and property damages, for which they would be financially compensated.

By March 27, 1907, we find the State Engineer, Frederick Skene, presenting to the Canal Board estimates on the two routes and submitting to that body the question of making the change. In the extended study given to the subject it had seemed best to make certain changes in alignment still farther to the west and so these estimates cover the distance from Fox Ridge to Macedon, 34.74 miles by the Savannah route and 42.82 miles by the "south," or "low level" line. The estimate along the course established by the law was \$9,373,000, and by the new route, \$7,836,000, a prospective saving of \$1,537,000. The Canal Board ordered a committee to draft a bill to authorize the change and a little later, during the current session, the Legislature amended the original law (chapter 710, Laws of 1907) so as to allow the new alignment to go into effect.

It was two years earlier, however, that the first radical change in the Barge canal law had been made, but in following topically various early studies made by the engineers we have deferred the consideration of this subject until now. This change was an amendment (chapter 740, Laws of 1905) which was so worded as to allow making the locks of larger size. The original law said, "The locks shall have the following governing dimensions: Length between hollow quoins, three hundred and twenty-eight feet, clear width twenty-eight feet, minimum depth in lock chamber and on mitre sills eleven feet." The amendment inserted the word "minimum" before the words "length" and "width," thus making each of the three dimensions minimum dimensions, but not definitely specifying them. In this manner the Legislature had evaded the responsibility of fixing the new dimensions, passing it on rather to others, and those upon whom it fell were the members of the Canal Board. It might naturally be supposed that the State Engineer and the Advisory Board of Consulting Engineers were better qualified to pass upon this subject; at least they were the officials who had given it greatest thought and knew the most about it, but since the Canal Board must approve all plans before any construction work could be undertaken, the final decision of this question really devolved upon that body. It happened that in this instance there were marked differences of opinion. The State Engineer and the Advisory Board desired to increase both the width and the depth, but the majority of the Canal Board were opposed to the increase in depth and of course their opinion prevailed.

After the passage of this amendment the first official step toward reaching a decision was taken by the Canal Association of Greater New York. Within a few days the Canal Board and the State Engineer received letters transmitting resolutions adopted by this association urging the State officials to make the new locks at least 45 feet wide and 14 feet deep, saying that the exigencies of commerce and traffic called for such enlargement and that by so doing the canals would be placed on a par with the best equipped waterways of the world. The Canal Board in turn requested the State Engineer to obtain the opinion of the Advisory Board on the subject. This he did and the reply of the Consulting Engineers is worth examining. It was in the form of a rather extended resolution, the gist of which was that the locks on existing Canadian canals were 45 feet wide and 14 feet deep and a prospective Canadian waterway would have locks at least as large; that a proposed

canal from Lake Erie to the Ohio river would be 15 feet deep and have locks 45 feet wide and proposed navigation on the Illinois and Mississippi rivers would be 14 feet deep; that European countries, appreciative of the advantages of standard canal dimensions, were working toward that end; that the contemplated enlargement would decrease cost of transportation both by increasing tonnage of vessels and, because of greater depth, by reducing tractive force; that it would enable the Barge canal better to compete with rival water and rail routes and might be to the advantage of such barge owners as contemplated the use of their barges in coastwise traffic during the winter; that 76 per cent of the total Barge canal length lay in the open waters of river or lake and much of the remaining 24 per cent was wide enough for two boats of 43 feet beam to pass and plans could be so drawn as to make easy the widening of the rest and also the deepening of the whole channel to 14 feet when traffic required; that the additional cost of larger locks could be met without overrunning the money appropriated; that the contemplated water-supply was sufficient for locks of increased size, and therefore the Board was of the opinion that the locks should be 45 feet clear width and have 14 feet depth of water over the miter-sills.

It chanced that, when this measure became law, contracts had already been let for building three locks. The plans for these called for 28 feet width and 12 feet depth. As we have said, State Engineer Van Alstyne desired to increase these dimensions to 45 and 14 feet and in this stand he was backed by the Advisory Board, but to do this it was necessary to make alterations to the plans then under contract and also to have future plans containing these new dimensions approved by the Canal Board. The law provided that no alterations could be made without the consent and approval of the Superintendent of Public Works and the State Engineer. Mr. Van Alstyne knew that Superintendent Franchot would not consent to a depth greater than 12 feet and he knew too that the majority of the Canal Board also was opposed to increasing the depth. Therefore he did not attempt to bring the question to an issue, but he made very plain his own position in the matter, going on record in his annual report of 1905 and publishing a complete account of the transactions.

The dimensions of the locks as fixed at that time are those upon which these structures have been built—45 feet wide, with 12 feet of water over the sills. Under the amendment the length also might have been increased, but there never developed any reason

for doing this, except that as a matter of fact the locks are actually more than 328 feet long between the hollow quoins, ranging from about 338 to 343 feet. This dimension, however, is a mere detail of design; the length in the lock chamber available for boats has not been increased beyond the original intention but to allow for the swing of the gates and other necessities a greater distance between the gates was found essential.

At the beginning of Barge canal planning the State Engineer adopted a certain policy which the future may reveal as of great advantage to the State but which is scarcely known by any one except the engineers. Past experience had taught the wisdom of anticipating possible channel enlargements and so provision was made for increasing the minimum bottom width from 75 to 110 feet without unnecessarily having to undo what was then being done. The structures spanning the canal were built to fit this plan and excavated material was placed where it would not have to be rehandled in case of a future widening. Also sufficient right of way was acquired for such a contingency.

A study made during the second year of Barge canal activities was the beginning of an effort which eventually saved for the State about a million dollars. It will be recalled that when State Engineer Bond revised his estimates in response to a request from the 1903 Legislature he added an amount for work in the Hudson river from Troy to Waterford and in the Niagara river from Tonawanda to Buffalo. This he did lest the Federal government should not take upon itself the improvement of these stretches, as had been assumed when the earlier estimate was made. This amount was \$1,403,307. The respective portions according to 1901 prices were \$737,683 for the Hudson and \$538,051 for the Niagara. When surveys for making plans were begun, after the approval of the referendum, the engineers gave little attention to these sections, hoping that the United States would undertake the task. And the hope was well founded, for the river and harbor act of 1905 contained an item authorizing the expenditure of seven hundred thousand dollars for improving the harbor and channel at Black Rock and for constructing a ship canal around the upper rapid of the Niagara at Black Rock. This act seemed definitely to commit the Federal government to the improvement of the Niagara river from Buffalo to Tonawanda and such in fact has proved the case. Except for terminal construction at Buffalo the State has not had to do anything beyond the entrance into the Niagara river at Tonawanda. This same act contained also an item which authorized the

Chief of Engineers to make a survey and an estimate of cost for improving the Hudson river between Congress street bridge, Troy, and the eastern terminus of the Barge canal at Waterford.

In addition to furnishing the United States engineers with all pertinent data in his possession and urging them to speed their investigations, in order that if possible the next river and harbor bill might include an appropriation to extend the 12-foot channel (which the Government had already excavated to Troy) as far up the Hudson as Waterford and possibly to Northumberland, State Engineer Van Alstyne caused to be made a study of the reasons why the Federal authorities should assume this task. The results of this study he published in his annual report for 1905 and also in pamphlet form. So conclusive are the arguments in this monograph and so almost amazing are some of the facts disclosed that we must examine it with considerable care and at some length.

The policy of the United States toward purely natural waterways and even toward occasional artificial canals, this study points out, is well defined, both by the words of Government officials and also by precedent from the time of the first river and harbor bills to the present day, and that policy emphatically declares the obligation of the central Government to establish and maintain the improved natural waterways where these improvements are obviously needed by large public interests and are sought by commercial movements of a magnitude sufficient to warrant the expenditure. The right to regulate commerce entails the responsibility of providing for that commerce. Thus New York, in respectful recognition of the Federal government's authority over its rivers and harbors, was seeking the expenditure of a moderate sum upon one of the greatest natural waterways of the country.

Moreover the proposition for a canal entirely across New York state had long been a favorite theme with the National government and in its surveys three routes had been considered — one from Lake Erie to the Hudson, another from Lake Ontario to the Hudson and the third from the St. Lawrence through Lake Champlain and the upper Hudson to the head of navigation at Troy. In spite of the magnitude of the task New York State had now begun a great canal along not only one but all three of the routes projected by the United States government, and thus was simply executing the plans proposed by the Federal authorities and taking upon itself a work which, together with the Panama and a very few other canals, had been deemed worthy of weighty and costly consideration by the National government.

If the canalization of the Hudson should be considered apart from the great system of State canals, the Government still had the strongest reason for extending its aid, since it had long before adopted the Hudson river up to the State dam at Troy as its own, having maintained and committed itself to the preservation of a navigable channel of 12 feet depth northward to that point. Moreover that river presented the spectacle of being one of the mightiest watercourses to penetrate the interior of our country, bearing at that time a traffic of but little less than twenty million tons yearly and having exercised, perhaps, more of an influence upon our nation's history and welfare than any other.

In addition the project afforded an opportunity for the Federal government to extend its aid to an inland section cut off of necessity from participation in many of the privileges of the coast and the appropriations therefor. In this section lay Vermont, the only state north of Mason and Dixon's line and east of the Mississippi river which has no frontage on either the Great Lakes or the ocean and therefore is entirely dependent on an artificial outlet. As an international waterway the general Government might therefore well afford to lend a helping hand, especially since Vermont had had a very meager allotment from the river and harbor expenditures of the nation.

That the waterway up the Hudson river and across to Lake Champlain was by no means exclusively for the interest of the port or the state of New York the study clearly proved. The records of export trade of the five leading Atlantic ports of North America — New York, Boston, Baltimore, Philadelphia and Montreal — sounded an unmistakable note of warning that Montreal, as a rising competitor, was no mere illusion. Of these five great Atlantic ports, the Canadian metropolis had doubled its proportion of the total export trade in the preceding twenty-five years, its trade having grown steadily and rapidly all through that time and continued uninterruptedly throughout the decline experienced by the other four ports during the last half decade of the period. Evidently the United States had somewhere been negligent in its effort to hold the export trade from the interior, and apparently too the Canadian government was actively reaping the benefits of its liberal canal policy.

The strongest argument, perhaps, for the central Government coming to the aid of New York lay in the comparison between the amount of foreign commerce passing through New York and the proportion of Federal expenditures which the State was receiving.

And this argument, by the way, applies and has been used with still greater force in attempts to persuade the Federal authorities to improve the New York port facilities for handling the vast amount of export and import commerce that passes every year through that harbor. In 1904 the combined export and import trade of New York state was practically equal to the sum total of all the combined export and import trade of the remaining 90 per cent (by population) of the United States, and yet this State received as a return benefit with which to maintain its facilities for handling its immense contribution to the commerce of the country only $7\frac{1}{2}$ per cent of the total expenditures for river and harbor improvement. A review of the records for the preceding decade told the same story for each year, except that generally New York's share of commerce had been a little more than half that of the whole country. Moreover New York had never had more than about the same percentage of Federal aid. Of the total appropriations for river and harbor improvement from 1802 to 1904, inclusive, which amounted to a trifle less than a half billion dollars, New York has received only $7\frac{1}{4}$ per cent, and the inclusion of projects along the New Jersey and Vermont boundaries did not materially alter the proportion. The monograph pointedly asks, "If, as a Federal statesman has said, 'The General Government improves channels and harbors and imposes a charge upon commerce with a view to obtaining compensation for the improvements,' is it right that a State furnishing, as did New York in 1904, sixty-four per cent of the imports of the Union, the item upon which this 'charge' is based, should yet recover less than eight per cent of the resulting expenditure for 'improvement'?"

Viewing the question from various angles the study showed that New York had commercial interests comparable with those of any foreign nation and that in the volume of her traffic per capita she was surpassed by only one people on the face of the earth. Also that the State, while it constituted an important part of the country, still possessed a far smaller proportion of the population, wealth and income of the United States than it furnished of the commerce and therefore had need of the assistance of the Federal government, to which it turns over all the revenues of its foreign trade. The meagerness of the allotments to New York was emphasized by a table in the 1904 report of the Department of Commerce and Labor, which showed the quantity of freight handled on seven of the leading waterways of the country and also the total United States appro-

priations for each from 1802 to 1900. No Federal aid had been extended to the New York canals and yet they, even at that low tide of their career, were carrying a traffic second only to that of the Monongahela river, the leading waterway of the table, and 85 per cent of the tonnage on the Monongahela was simply coal floated downstream. Moreover the Hudson river, which was not included in this Federal report, was carrying twice as large a traffic as the Monongahela.

New York's appeal called attention to the significant fact that in the great continuous chain of waterways which reach from the Atlantic coast through to the western extremity of Lake Superior that portion across New York state from the Hudson to Lake Erie was the only link for which the Federal government had not expended its millions, and yet that portion — even for the freight going all or in part by rail — was the key to all the rest of the route, the key, in the language of the Twelfth Census, to the "greatest internal waterway in the world, having a ton mileage equal to nearly 40 per cent of that of the entire railroad system of the United States."

The study revealed some striking facts in regard to State expenditures and Federal appropriations for rivers and harbors. Considering national appropriations on the basis of distribution according to population it was discovered that during the preceding decade New York had received \$1.69 per capita while the per capita expenditure for the whole country was \$2.33. Applying the same test to the total appropriations from 1802 to 1904, the expenditures for New York and the United States, respectively, were \$4.66 and \$6.16 per capita of the population in 1900. Compared with other states it appeared that whereas New York had received aid to the extent of \$3.92 per capita between 1802 and 1900 some of the western states, which had been settled during the last half of that period, had secured much larger amounts, as for instance Oregon and California, whose shares were \$6.73 and \$6.19, respectively. Although New York is the only state with both lake and ocean frontage to consume its appropriation, other states had fared much better. Wisconsin had had \$5.32, Maine \$7.28, Florida \$8.76, Texas \$5.07, Michigan \$10.18, Rhode Island \$8.24, Maryland \$4.33, South Carolina \$5.34 and West Virginia \$5.18.

On the other hand New York, although she had always felt that the through routes of communication she had provided to the interior merited some share of national consideration, upon being

refused, had again and again bent herself heroically to the task, alone and unaided, and had already spent on her canals a sum amounting to \$29.30 per capita of her 1900 population and had begun a new enterprise which would increase the amount to \$43.19 per capita. The Government aid she was now requesting for both the Hudson and the Niagara projects was but 98 cents per capita of the state population, or nine cents per capita of the population of the whole country. In comparison it was seen that France had expended \$20.45 per capita in the improvement of rivers and harbors. All Europe in recent years and with remarkable unanimity had awakened to the demands and the benefits of water transportation for the interior, and in England, Germany, Belgium, the Netherlands, Russia and Austria vast sums were being spent in extending and improving navigable waterways and connected harbors. New York's next door neighbor, Canada, had spent no less than \$18.62 per capita of her present population and also then had under way projects which would double this sum, assuring a per capita expenditure of \$37.24. That New York, almost single-handed, should be called upon to contest these extensive outlays, made for the immediate and avowed purpose of diverting the interior traffic from United States to Canadian channels, was — whether just or unjust — the existing situation.

It appeared, in short, that the 10 per cent of the population of the United States composing the state of New York was charged with the expense of accommodating 50 per cent of the foreign trade, the receipts for which it turned over to the general Government, and that in return it was assisted by that Government to the extent of just about 7 per cent of the total moneys appropriated for harbor and river improvement for the utilization of the commerce of the realm.

We shall close our review of this study with two quotations. "Thus it appears," reads the monograph, "that the United States Government, which from the beginning has expended upon New York only about \$4.66 per capita of that State's population, has fallen as far short of a noble emulation of foreign and neighboring countries as has New York State herself — though stripped of the direct revenue of her commerce — exceeded these nations in the amounts of her appropriations, in her devotion to the principle of internal navigation, and thereby in her gratuitous service to the vast interior of the land."

And again, "Will the Congress consider what would have been lost to the United States had not the New York canals been con-

structed? Will that distinguished body reflect what assured national benefits would have been impugned had the State Government and the people lately yielded to the clamor of many who urged the abandonment rather than the renovation of the system and the expenditure of another hundred million of dollars? And will it refuse the well deserved assistance, because, forsooth, it knows the community has energetically made up its mind to prosecute this beneficent international undertaking, even though it should have to stagger under the weight of other men's burdens?"

The general Government had already in effect pledged itself to the consummation of the Niagara project and this work was duly carried on to completion. Later, in deference to New York's appeal, it undertook also the Hudson river project but not until several years had elapsed, and then various complications arose still further to delay the beginning of construction work. We shall therefore suspend consideration of this subject until the appropriate time is reached.

We have seen that by the Barge canal act there was created a body called the Advisory Board of Consulting Engineers. The members were appointed by the Governor and it was their duty, paraphrasing the law, to advise the State Engineer and the Superintendent of Public Works, to follow the progress of the work and from time to time report to the Governor, the State Engineer and the Superintendent of Public Works as these officials might require or as the Board itself might deem proper and advisable. Before canal plans had much more than begun an additional act of the Legislature (chapter 200, Laws of 1904) provided that the terms of office of these advisory engineers should continue during the period of canal construction.

An important feature of Barge canal construction, one that is now recognized as perhaps the most vital of all to the success of the venture but which was overlooked in the early stages of the project—the providing of suitable terminals together with their accompanying freight-handling machinery and other facilities—was first given official cognizance during the period we have recently been considering. In its first report to the Governor, which covered the activities of 1904 and 1905, the Advisory Board of Consulting Engineers says that the question of terminals at Tonawanda or Buffalo and at New York city had been brought to the attention of the Board by various commercial organizations interested in the canal and had

been emphasized by statistics presented at a hearing before the Congressional Committee on Rivers and Harbors when Federal aid was being sought for the canal in the Niagara river at the rapids at Black Rock, between Buffalo and Tonawanda. But it was not until 1909 that any effective action was taken to supply the canal with terminals and so this subject too will be deferred to a later time.

A question of policy which came up after construction work had been progressing for several years was that of changing the type of bridges on certain portions of the canal. A commission was appointed in 1909 to study the subject to which we referred in the preceding paragraph, that of terminals, and it was a recommendation of this commission which led to this change in the bridges. In a preliminary report to the Legislature in 1910 the commission urged the amending of the Barge canal law so as to provide for bridges over the canalized Tonawanda creek which would leave an unobstructed channel for the passage of masted vessels, it being essential in the terminal development at the western end of the Barge canal to bring vessels having masts or funnels into the lower reach of that stream, where direct transfer might be made to canal barges. The original law required that all fixed and lift bridges should be at such a height as to give a clear passageway of not less than $15\frac{1}{2}$ feet between the bridge and the water at its highest ordinary navigable stage. The desired amendment, duly passed by the Legislature in 1910, added the words, "When recommended by the state engineer and surveyor and approved by the canal board bascule or swing bridges may be constructed."

But the provisions of this amendment could be invoked at any point on the canal and almost immediately Syracuse took advantage of this privilege and sought to have the new type installed on the section of channel lying between its harbor and Lake Ontario, a stretch comprising the whole of the Oswego canal, a portion of the Erie branch and the spur through Onondaga lake to the city. The object of course was to bring Great Lakes boats to the wharves at Syracuse, and bridges giving unlimited headroom were essential to its attainment. The project was largely agitated locally and had the backing of the commercial authorities of the city. A bill ordering this change was introduced in the Legislature in 1910, but it failed and what was really accomplished was the passage of a concurrent resolution directing the Terminal Commission to investigate the subject and report to the Legislature of 1911. The Commission studied the question carefully and reported that the cost of changing all the

bridges except those between Onondaga lake and the proposed Syracuse harbor would cost about \$520,000 and a capitalization of a half million more would be needed for maintenance and operation. Between Onondaga lake and the Syracuse harbor extensive railroad freight yards presented a complex problem, which could not be solved in conformity with the desired change for less than \$750,000. The commission was of the opinion that the benefits to be derived by either Syracuse or the State were not commensurate with the expenditure of the million and three-quarters involved. Moreover some of the bridges had been or were being raised or altered to fit the 15½-foot requirement and others were already at a height to need no reconstruction. There were four bridges, however, which were still to be rebuilt and as the additional cost would not be large the commission recommended that they be constructed so as to be capable of being transformed later into swing or bascule bridges without the sacrifice of any of the original cost.

A little later Syracuse petitioned the Canal Board to make the bridges over the Oswego canal of the movable type and the Board subsequently acceded to the request. In the minutes of the Canal Board proceedings for September 27, 1911, may be found the record of the State Engineer's recommendation that all new bridges to be constructed over the Erie canal in the vicinity of Tonawanda or over the Oswego canal be either bascule bridges or of a type convertible into bascule bridges; also the Board's resolution approving this type of construction. As a result the four bridges on the Oswego branch have been made of the convertible type, as it has been called, and others not at the time contemplated are bascule or swing bridges.

An interesting side-light in this report of the Terminal Commission is the admonitory addendum urging that all further inroads upon the Barge canal funds be peremptorily stopped. It seemed probable that the whole project would be completed within the appropriation and therefore it should not be permitted, said the Commission, that any obstacle should be thrown in the way of so desirable a consummation. The immediate occasion of this warning to the Legislature was the attempt of Syracuse to have the change of bridge type ordered by legislative action without special appropriation being made for the specific purpose. The canal appropriation had already been taxed with burdens it was not originally intended to bear and this was but one of several attempts to do the same thing again.

CHAPTER VIII

THE ADDITION OF ANOTHER BRANCH—THE CAYUGA AND SENECA CANAL

Survey of 1905 to Cayuga Lake—What Existing Arrangement Would Mean—Report of 1905 Survey—Agitation Renewed in 1909—Improvement Recommended by Superintendent Stevens—Paper Read at Waterways Meeting—Senate Asks for Estimate and Report—State Engineer Williams Replies—Explanation of Names—Estimates of Cost—Possibility of Separate Seneca Lake Branch—State Engineer Recommends Survey—Legislature Passes Bill Authorizing Improvement—Governor Approves, Choosing between Two Referenda—Survey also Ordered—Authorizing Law Leaves Choice of Seneca Route Open—Survey Parties Soon in Field—Seneca Routes Investigated but Old Line Chosen—First Contracts Let in 1910—Amendment of 1911 Adds Branch between Watkins and Montour Falls.

WHEN the State Committee on Canals made its report to the Governor in 1900, recommending the improvement of the New York State canals, it gave as one of its conclusions that the Cayuga and Seneca and the Black River canals should be retained as navigable feeders but that they should not then be enlarged. This advice was followed throughout the period of agitation and eventual authorization and also until construction had begun on the three main branches, but soon thereafter it appeared that the people of the finger-lakes region desired a share in whatever benefits the new canal might bestow and were trying to have their waterway included in the scheme of improvement.

The first effective move in this direction was a bill in the 1905 Legislature directing the State Engineer to make a survey, together with plans and estimates, for a canal from some point on the main waterway near Seneca river to Cayuga lake. We have seen already how this survey fitted in with a plan to change the alignment of the Erie canal in this vicinity; how this plan began with an attempt to avoid certain difficulties at Savannah by altering the line for a few miles and grew until it embraced a stretch of about forty-three miles, extending from Fox Ridge to Macedon. This change of alignment was made, it will be recalled, by amending the Barge canal law in 1907. A potent factor in effecting this change, it will also be remembered, was the consideration that it brought the

Erie channel five miles nearer the foot of Cayuga lake. At the time of making this first survey and during the two years or more of studies and deliberations on the contemplated change in the Erie route it was realized that the two schemes were closely interdependent and that in deciding either question its effect upon the other must be regarded as of prime importance.

The people living near the Cayuga and Seneca canal brought forward many forcible arguments in their appeals for enlarging this waterway and some of these will appear a little later. But for our understanding of the situation as it then stood—what would happen if no improvement should be made by the State, how, aside from being denied participation in a larger channel, all navigation of the canal would be subjected to greater inconvenience than in the past—we must remember that the Barge canal deviates in general from the old channel, in some places by a distance of several miles, and we must know in particular that in this vicinity the two lines were wide apart for many miles and under the arrangement of the original law the only connection between the Cayuga and Seneca canal and the new Barge channel would be by way of the existing Erie canal from Montezuma to Syracuse and thence down the existing Oswego canal to its entrance into Seneca river, in all a distance of about 39 miles. We must know also, in order to perceive one important reason for both changing the Erie route and making direct connection with the Cayuga and Seneca branch, that it would have been necessary otherwise to keep open these portions of the existing Erie and Oswego canals simply for supplying an outlet for the Cayuga and Seneca canal and that except for this need they might be abandoned after the Barge canal improvement should be completed.

The report of the survey to Cayuga lake, which is dated March 26, 1906, showed three estimates, \$2,677,000, \$1,918,000 and \$1,647,000, which were for channels having 12, 9 and 7 feet depth of water, respectively. The estimate for the 12-foot channel was an estimate, of course, for a waterway of Barge canal dimensions. One lock would be required and this was estimated along Barge canal lines, having the same length and width but a depth corresponding with the three respective depths of channel. It had been found that before deep water should be reached a channel of considerable length would have to be excavated into the north end of Cayuga lake. The distances were 7 miles for the 12-foot, 3½ miles for the 9-foot and 2½ miles for the 7-foot depth.

At the time of making this survey the change of route in the new Erie branch was still under deliberation and so the estimate contemplated a line from a junction about a half mile west of Fox Ridge to deep water in Cayuga lake. No specification as to size of the proposed channel appeared in the authorizing act, this question being left to the discretion of the State Engineer. Mr. Van Alstyne held the position of State Engineer at the time and his decision, as we have seen, was the submission of estimates for three sizes, a plan which permitted a study of comparative costs. A depth of twelve feet was Barge canal size, one of nine feet was what the existing Erie was supposed to be, while seven feet would be no increase over the existing Cayuga and Seneca depth, but a new location was chosen, the same for all three depths, and this followed in general the river channel, while the old canal ran in a land line close to the river but slightly above it. The law ordered a survey only to Cayuga lake and that was as far as it was carried, but the idea of extending eventually throughout the whole length of the canal whatever improvement should be made was evidently in the minds of those concerned. In fact the report of the State Engineer treated somewhat of the benefits of having direct water communication with the heads of Cayuga and Seneca lakes, both close to the coal fields of Pennsylvania, and also of providing access by water to salt-producing works on each lake and to some building stone quarries and a cement plant on Cayuga lake.

It was not till 1909 that agitation for an improved Cayuga and Seneca canal was vigorous enough again to catch the public eye. Doubtless the friends of the project had been working quietly. Such matters seem usually to move rather slowly and three years had now elapsed since State Engineer Van Alstyne had presented his report of the first survey to the Legislature, but during the session of 1909 events moved swiftly and before it closed the success of the issue had been accomplished so far as it could be till the people passed upon it at the ensuing general election. During the period of apparent quiescence, however, the route of the main canal had been changed by legislative amendment and now its nearest point was only four miles from the foot of Cayuga lake.

In his report to the Legislature in January, 1909, Superintendent of Public Works Stevens made a strong plea for including this canal in the number of those to be improved; he enumerated some of the prospective benefits and called attention to the possibility of adding the two lakes with their eighty miles of natural navigation

amidst important industries to the Barge canal system by building only about twenty-four miles of waterway. While he had not the data upon which to base an accurate estimate he thought the portion between the new Erie junction and Cayuga lake could be built for \$1,750,000, and that from Cayuga lake to Seneca lake for \$4,000,000.

At about this time there occurred a conference of waterway advocates in Brooklyn, assembled for the purpose of organizing what became the New York State Waterways Association, a body which from its founding has been the channel through which concerted public action has endeavored to advance the interests of the canals, a body, moreover, made up of representatives from many of the same commercial organizations which have backed the canals during the thirty-five years that the later series of improvements has been going on. The Cayuga and Seneca project was placed before this conference in a paper read by Jared T. Newman, who had just served Ithaca as mayor. One or two of Mr. Newman's statements will suggest why the arguments for this improvement prevailed. There was a single cement plant on Cayuga lake, said he, which had a capacity of one thousand barrels a day and bade fair to produce that amount in 1909. But the cement industry in that vicinity was still in its infancy. Gypsum also was produced in large quantities on Cayuga lake. But more important than these was the production of salt. Already Tompkins county, on Cayuga lake, and Schuyler county, on Seneca lake, in the order named, stood next to Livingston and Wyoming in the quantity of salt produced in the state, Onondaga, the original large salt producer, coming after Schuyler. "As a matter of fact," to quote Mr. Newman's language, "layers of solid salt 248 feet in aggregate thickness underlie Ithaca and Watkins — a quantity sufficient to supply the world, and more available to tide-water than any other large deposit. The estimated output of salt and cement for the year 1909 from the plants along the two lakes is 500,000 tons, while the total tonnage by boat last year was only about 81,000 tons."

The immediate result of the recommendations made by the Superintendent of Public Works was a Senate resolution, dated February 4, calling on the Superintendent and the State Engineer for an estimate of probable cost and such other information as would enable the Legislature to make an intelligent study of the whole question and also come to a decision as to what step, if any, it should take in inaugurating the suggested improvement.

The State Engineer, Frank M. Williams, replied to this request. Such data as were available were filed in his office and chief reliance had to be placed on this information, since a speedy answer was required and no time was allowed for adequate surveys. Mr. Williams' report was dated March 27 and in it we find that he divided the project into two parts, one the section from the new Erie canal to Cayuga lake and the other from Cayuga lake to Seneca lake. For the former section the survey made in 1905 furnished sufficient data, but for the latter section little was at hand upon which to base an estimate for constructing a channel of Barge canal dimensions. But from the best information obtainable, from comparison with somewhat similar work already under contract on the Barge canal improvement and from a few such hurried surveys, soundings for rock and personal examinations as could be made an estimate was prepared. As the State Engineer said, however, this could at best be regarded only as approximate.

Parenthetically it may be said that the division of the Cayuga and Seneca canal into two parts was a feature in the history of the waterway which did not appear until just about this time but which presently led to a confounding of names. All through its existence up to this time it had been known as the Cayuga and Seneca canal but the act of 1909 called it the Cayuga and Seneca canals. This was not an inadvertent error; the law described separately and with exactitude the routes which it designated the Cayuga canal and the Seneca canal. The reason for this change and the circumstances leading to it are easy to discern. The entering wedge in the attempt to connect the Cayuga and Seneca branch with the Barge improvement was the survey of 1905 and this included only the portion to Cayuga lake. The Superintendent of Public Works in his rough estimate of cost naturally separated the part based on an actual survey from that which was more or less of a guess. The State Engineer was compelled to make a like division for a somewhat similar reason, but also, as will appear presently, he thought that he might be able to find an advantageous connection between Seneca lake and the new Erie canal by going directly north and not diverging easterly to Cayuga lake, as ran the course of the existing canal. But investigation showed the old route to be better and the Barge canal improvement has followed a route not separated widely from the old canal. Indeed the difference in alignment is less than on much of the Erie branch, since portions of the old Cayuga and Seneca were already river canalizations. There seems to be no sufficient reason, therefore, for



Approach walls to a lock. All locks have approach walls, some long, others comparatively short. In the river lines guide piers often supplement the upper approach walls. The lock in the view is the second of the Waterford series. The fleet, consisting of six barges of old canal size and a tug, nearly fills a barge canal lock and may be passed at a single lockage.

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changing from the old name. It may hark back to a style not common nowadays in assigning names to new enterprises, but that is of small account. This is the same waterway that was built in 1825-28, any changes since that time having been essentially nothing but enlargements, and it is best that its identity should be preserved. To this end we are careful to use the original name in the present volume. In general the same rule has been followed in all publications of the State Engineer's department. Moreover, although the phrasing seems well advised for various recent projects, we steadfastly abstain in this instance from that hyphenated modernism employed by some persons, the Cayuga-Seneca canal.

State Engineer Williams' estimate, in his report to the Legislature, was based on a channel of Barge canal dimensions. Furthermore the same essential features of construction were adopted. It would be a serious error, he said, to sacrifice on this canal, for the sake of economy, the rules of good curvature and alignment and the standards of stability and completeness established on the main waterway. At one particular locality, however, a saving could be effected. The existing canal circled the north end of Seneca lake in a land line, continuing for about two and a half miles beyond the point where access to the lake was first possible. Because of new methods of propulsion inherent to Barge canal navigation, direct entrance into the lake would entail no hardship on boatmen and so this shorter course was planned. The estimated cost for the section from the Erie branch to deep water in Cayuga lake, a distance of 10.8 miles, was \$1,565,543. The extension from a point on this line to deep water in Seneca lake was 13.7 miles long and was estimated to cost \$6,528,233, making the total for the whole canal \$8,093,776.

The State Engineer added that he had some reason for believing that there might be found a route from Seneca lake to a junction with the main Barge canal which could be built at less expense than would be involved in canalizing the Seneca river along the existing canal. He recommended the appropriation of \$40,000 for making surveys from which to prepare detailed plans and accurate estimates and also contract drawings for such portions of the work as should be undertaken first. This preliminary work would occupy about a year and its accomplishment, in anticipation of a speedy authorization of the improvement, would hasten the completion of the canal of course by that much time.

A bill to enlarge the Cayuga and Seneca branch to Barge canal dimensions and carrying an appropriation of \$7,000,000 was passed

by the Legislature of 1909. It was one of the thirty-day bills left in the hands of the Governor after adjournment. In the natural course of events it was necessary for a bill of this character to run the gauntlet first of the Governor's endorsement and then of the people's approval at the ensuing general election, but this particular bill was subjected to a more severe test. The Legislature had complaisantly yielded to other strong influence and had left with the Governor also a bill for the issue of bonds to the amount of \$2,000,000 for pensioning Civil war veterans, despite the constitutional restriction that only one measure carrying a bond issue might be submitted at any one election. Thus the Governor not only was compelled to determine the advisability of the propositions but was placed in the dilemma of choosing between them, and both were strongly endorsed by large and influential organizations. Moreover the advocates of each bill were necessarily forced to seem to be the opponents of the other.

To help him decide the difficult question Governor Hughes gave a hearing at which both measures might be argued. The veterans were well represented by delegations and spokesmen and their strong plea was that the canal scheme could wait while the rapid rate of depletion in their ranks called for immediate action. For the canal there spoke George Clinton of Buffalo, Jared T. Newman of Ithaca, and Henry B. Hebert of New York. Canal delegations were present and others were to have spoken but time forbade. The argument which seemed to hold the Governor's attention closest and make the strongest impression on him was that advanced by Mr. Clinton, who held that the pension bill was unconstitutional and even if approved by the people would not become operative and afford the desired relief.

The Governor signed the canal bill and it became chapter 391 of the laws of 1909. We need not examine its provisions in detail. In general the act closely resembled the law which authorized the improvement of the Erie, Champlain and Oswego canals and in many features it was identical with the earlier law. The supply bill of 1909 contained an item of \$20,000 for making a survey of the Cayuga and Seneca project and this too received the Governor's approval.

But there is one clause in the new law which we must notice. As we have seen already, the act separated the canal into two parts. One extended from near the confluence of Seneca and Clyde rivers to deep water in Cayuga lake and was called the Cayuga canal; the other began at a junction with the Cayuga route and went to

Seneca lake, being denominated the Seneca canal. After describing these two courses, the law provided for an alternative route, which would stretch northerly from Seneca lake and join the Erie canal in the vicinity of Lyons. This latter route might supersede the easterly line to Cayuga lake along the existing canal. The act placed on the State Engineer the duty of making the necessary surveys and estimates to show comparisons of cost and desirability, and laid on the Canal Board the responsibility of making the final choice between routes.

With a fund available for surveys without waiting for the whole appropriation to be approved by the electorate, parties under the immediate direction of Deputy State Engineer H. W. De Graff were in the field by the first of June and before the end of the calendar year the surveying and mapping had been almost completed and computations were being pushed. Information was at hand for beginning contract plans as soon as the choice of routes should be made. The referendum was carried by a majority of 69,097. Four constitutional amendments voted on at the same time were also approved and of the five measures the canal project stood second both in the number of votes cast for and against it and in the size of its majority.

The possibility of finding better alignment than that of the existing canal led to very thorough investigations, especially along the prospective line running north from Seneca lake, some twelve schemes having been studied. These included routes by way of Canandaigua outlet and also through a chain of small lakes and streams two or three miles to the east of this outlet, with termini at either Geneva or Seneca lake outlet on the south and at Lyons or Creagers bridge on the north, with both constantly descending levels from the lake to the Erie canal and also summit levels and a consequent water-supply midway. On the line east from Seneca lake a possible course other than along the existing canal was examined. This route followed Seneca outlet nearly to Waterloo but diverged thence to the south, avoiding the built-up portions of Waterloo and Seneca Falls and reaching Cayuga lake several miles above its foot, at a point directly east of Seneca Falls. The route selected, however, followed substantially the line of the existing canal, which was also largely the channel of the natural outlet of Seneca lake.

After the route had been determined the preparation of contract plans advanced steadily. The close of 1910 saw contracts in force for constructing a lock and controlling works at the foot of Cayuga

lake and for excavating 17 miles of channel. This included all the channel except about seven miles, this portion being chiefly the stretch between Waterloo and Seneca Falls.

By an amendment in 1911 (chapter 453) the route was extended from Watkins, at the head of Seneca lake, to Ayres street in the village of Montour Falls. This addition constituted the lake level of the old Chemung canal, a stretch of $2\frac{3}{4}$ miles, extending from the lake to within a few feet of the remains of the first of the old locks. The Chemung canal was abandoned at the close of navigation in 1878. By an act of 1887 the lake level was again made a part of the State canal system and within a year or two thereafter had been repaired and reopened to navigation. But it did not remain open long, since a near-by creek, which is subject to violent floods, broke through a bank and filled the channel with bars for a considerable distance. It was this reopened portion of the Chemung canal which the amendment of 1911 made a part of the Cayuga and Seneca branch of the Barge canal. Although the amendment thus lengthened the canal, it provided no additional funds for the increased construction.

CHAPTER IX

THE TERMINAL COMMISSION, CANAL TERMINALS AND GRAIN ELEVATORS

Tardiness of Terminal Movement Strange—Earlier Feeble Measures—First Decisive Step, 1909—Broad Review of Terminal Question—Properly Controlled Terminals Essential to Water Transportation—Terminal Situations in Europe and America—Relation Terminal Charge Bears to Carrying Charge—Supreme Importance of Efficient Handling Machinery—Task Set Barge Canal Terminal Commission—Its Personnel—Its Work—Three Chief Terminal Investigations Almost Cotemporary—Time Ripe for Terminal Improvement—Essentials of Terminals—Report of Terminal Commission: Preponderance of Local Traffic: Large Volume of Available Home Products Shown: Decline in Through Traffic Due to Terminal Lack: Refusal of Railroads to Coöperate a Large Contributing Cause: Greatest Terminal Need in New York City: Preëminence of the Port of New York: Almost Utter Lack of Canal Terminals in New York: Certain Observations in Europe: European Ports Visited: Estimated Cost of Barge Canal Terminals: Commission's Recommendations—Terminals Authorized—Localities Included—Procedure in Construction—List of Terminals Built—Question of Hudson River Terminals Arises and Some Progress Made—Appreciation of Need of Elevators Growing—To the Fore in 1920—Elevators at Gowanus Bay and Oswego Authorized—Arguments Advanced for Elevators by State Officials—Details of the Two Elevators.

AT THE present time it seems almost incredible that it could have been eight years after the Barge canal was authorized before State-controlled terminals were added to the project. Indeed to those who have studied waterway problems and have followed canal terminal construction in New York state and who for years now have been thoroughly imbued with the idea that public terminals are an indispensable part of successful waterways, and also to a few others who have taken the pains to inform themselves on transportation topics, New York's long neglect of its canals in this respect has become a thing of surpassing wonderment. And yet it is not so many years since people began to realize that channels alone do not give transportation, or, as one writer puts it tersely and vividly, that waterways without terminals are as useless as electric wires without contacts. We can see now, however, that the State's neglect to furnish terminals was having its deleterious effect on traffic years before the Barge canal was projected. Still, New York, although it seemed slow to begin, did in reality take the lead among the states in the matter of building

and owning its waterway terminals. It is a fact also that at least a few of the leading advocates appreciated the need of terminals when the building of the Barge canal was being agitated, but they were biding their time, awaiting the suitable moment for launching the project.

But there have been those who long have known the importance of owning and controlling terminal facilities along our waterways. They are the people who have obtained possession of most of the water-front in seaport, lake harbor and river cities, and more often than not it has been the railroad interests that have thus obtained possession of these strategic sites.

Owning the terminals, these private and corporate interests have controlled the traffic and fixed the rates and generally their control has not been favorable to the waterways. The people at large, therefore, have not had a fair chance to know by experience the possibilities of economy in water-borne transportation, and the wonder is that they have been so long in awakening to the significance of their situation and in finding the effective cure for their commercial ills.

It was in 1909 that the State took its first decisive step towards providing terminals for its canals, but prior to that date it had from time to time attempted in a feeble way to prevent terminal extortions. In 1881 a Legislative committee had conducted an investigation on the subject of excessive charges and other abuses to which boatmen were subjected. Again, at the beginning of the nine-foot canal enlargement, State officials had urged the curbing of high terminal charges, in order that the full benefit of the improvement then in progress might be secured, the former season having seen many owners tying up their boats in preference to operating with such meager returns as prevailed. We have already learned what the New York Commerce Commission recommended in its report in 1900 — that terminals be provided at Buffalo and New York and that terminal charges be restricted by law. In its first report to the Governor, in 1906, the Advisory Board of Consulting Engineers had mentioned in a somewhat incidental way the need of terminals at New York and at Tonawanda or Buffalo.

It will be observed, however, that up to this time no broad terminal policy for the whole state had even been suggested in any official utterance. The idea appeared a year or two later and probably it was of gradual growth. After the State Engineer and the Superintendent of Public Works had both recommended the measure twice in their annual reports and after canal advocates had done considerable work by way of agitation, the Legislature in 1909

(by chapter 438) created a commission, generally known as the Barge Canal Terminal Commission, to study the whole question of providing terminal facilities for the canals of the state.

Before we follow this Commission in its trips of inspection throughout the state or later in a visit to European ports, for the Legislature of 1910 authorized an examination of foreign harbors, we shall consider the general topic of waterway terminals. The work of this Commission was most admirable and the subject of its inquiry most momentous. In service to the State the Commission stands only second in importance to, if it does not equal, the State Committee on Canals, the body which was called upon to formulate for the State a canal policy. In like manner the Barge canal terminals are second only in importance to the canal itself. And so, to gain a full appreciation of the part terminals and terminal facilities play in both the broad scheme of water transportation and the narrower sphere of canals and navigable lakes and rivers, and to get a wide outlook over existing conditions and needs—what has been done in a few places and what has not been done in a vast number of other places—and thus to be able better to understand the supreme importance of the terminal problem in New York state, we need to pause and study briefly this general subject of waterway terminals.

In this study probably we can do no better than to read what a national commission had to say concerning the urgent need in the United States for adequate waterway terminals, and what is more important, the proper control of such terminals. This commission spoke with authority. It had had ample opportunity to learn the situation both at home and abroad. This was the United States National Waterways Commission, a body composed of twelve members of Congress, seven senators and five representatives, Senator Theodore E. Burton of Ohio being chairman. This commission was a contemporary of the Barge Canal Terminal Commission, having been created by act of Congress only about two months earlier but making its final report about a year later than the New York commission. We quote at some length from this final report.* The section on the control of water terminals reads as follows:

“Undoubtedly the most essential requirement for the preservation and advancement of water transportation is the establishment of adequate terminals properly controlled. Under present conditions the advantage of cheaper transportation which the waterways afford is largely nullified by the lack of such terminals.

* Senate Document No. 469, 62d Congress, 2d session, pp. 20 and 21.

"According to the report of the Commissioner of Corporations on water terminals, private interests control nearly all the available water front in this country, not only at the various seaports but also along the Great Lakes and the principal rivers. Only two ports in the United States, New Orleans and San Francisco, have established a public control of terminals at all comparable with the municipal supervision existing at most European ports.

"The above-mentioned report on water terminals also shows that a large proportion of the most available water frontage is owned or controlled by railway corporations. Through this ownership or control they practically dominate the terminal situation at most of our ports, and they have generally exercised their control in a manner adverse to water traffic. In many cases they hold large tracts of undeveloped frontage which they refuse to sell or lease, and which are needed for the construction of public docks. This railway control of terminals is one of the most serious obstacles to the development of water transportation, for the control of the terminal means practically the control of the route. An independent boat line has small chance of success where it is denied the use of docks and terminal facilities or is required to pay unreasonable charges for their use. The high terminal charges at many of our ports make it impossible for small boat lines to enter at all.

"The commission believes that the proper solution of this terminal question is most vital to the future of water transportation. It is, however, more a local or State than a Federal problem. As pointed out in the preliminary report of the commission, there should be a proper division between the functions of the Federal Government and local communities in the improvement of waterways. The Federal Government should improve channels, while the municipalities should coöperate to the extent of providing adequate docks and terminals. It is absolutely essential for the growth of water transportation that every port, whether located on the seacoast or on some inland waterway, should have adequate public terminals, at which all boat lines can find accommodations at reasonable rates. Inasmuch as the indifference of communities to their responsibilities in this matter largely nullifies the benefits of expenditures by the Federal Government for channel improvements, the commission emphasizes the recommendation made in its preliminary report that further improvements in rivers and harbors be not made unless sufficient assurance is given that proper wharves, terminals, and other necessary adjuncts to navigation shall be fur-

nished by municipal or private enterprise, and that the charges for their use shall be reasonable. It can not be too strongly urged, that in many cases it is not the condition of channels so much as it is the lack of terminals that is retarding the development of water transportation.

"Where water frontage necessary for the establishment of public terminals is held undeveloped by railway or other private interests, a special act of the legislature should be passed, empowering State or municipal officials to condemn such property for public use. This plan has already been followed in a few cases and should be more widely adopted. The proposal has sometimes been made that the Federal Government should condemn private property and establish public terminals along the rivers and in the harbors which it is improving in order that the benefits of such expenditures may not be nullified. The commission, however, would not recommend the adoption of such a policy unless it shall be found after a fair trial that the States and localities can not adequately solve the problem."

We may gain a good understanding of what the terminal situation in Europe and America was at that time, and it has not changed much since, by referring to an excellent article on the subject in a book entitled *American Inland Waterways*, by Herbert Quick, published at about the time the two commissions were doing their work. From a chapter in this volume, headed "Terminals a Vital but Neglected Matter," we desire to select a number of outstanding facts. We shall quote the author verbatim in part and in part we shall give the substance but not the exact words. Also we shall add a few facts gleaned elsewhere. The chief original sources of information on terminals, it may be said parenthetically, are the reports of the three commissions we shall mention presently. This article reveals a broad outlook and a keen appreciation of the whole terminal field and the presentation of the subject is so lucid and convincing that the Barge Canal Terminal Commission reprinted the chapter in its entirety as an appendix to its final report.

It must be remembered that Europe led America by several years in caring for its terminal needs. Mr. Quick displays for our view the contrasting situations on the two continents. He shows that as a rule the municipalities of Europe built, owned and controlled their terminals. Antwerp, a city of fewer inhabitants than San Francisco and with only a few more than New Orleans, was the greatest port in Europe and second only to New York in the world. Her warehouses, railway tracks and all transshipment facilities

ties were owned and administered by the city and had drawn to her wharves the shipping of the world. She had spent \$45,000,000 and was spending \$55,000,000 more.

Hamburg had no natural advantages. Situated sixty miles up the Elbe, with mud and tide to contend with, by the spending of \$100,000,000 she had made her terminals so attractive that her commerce was growing faster than that of any city, save New York and Antwerp, and had already equalled that of London.

The docks at Liverpool were administered by a board so constituted that the interests of ship owners and shippers were considered rather than that of profits in docks. Situated on an estuary, with a difference of thirty-one feet between tides, having shifting sand bars and silt at its mouth, still this port had been built up by its own efforts alone, with no local or imperial taxation and had become one of the greatest in the world.

Rotterdam is another city that had won success by making her harbor a municipal monopoly. She had spent \$30,000,000, but not a dollar was furnished by the general Holland government.

After struggling for eighteen years to get control of her harbor, Havre succeeded in 1900 and began improvements. The growth of her commerce since 1900 had been astonishing. Plans under way contemplated spending \$17,000,000 in addition to the \$42,000,000 theretofore spent in making a harbor in an estuary with a tidal range of twenty-five feet and a bottom of shifting sand.

Other cities were mentioned, such as Manchester, Bristol, Glasgow and Newcastle, but this list will suffice. At London the story was somewhat different. Though still the greatest port in Great Britain, London had fallen behind New York, Antwerp and Hamburg and her antiquated port administration had often been charged with blame for this decline. She was seeking a reform, but the interest she must pay on the \$200,000,000 valuation of her docks showed the result of allowing them to fall into private hands.

Turning to America, the picture is not so attractive. New York was preëminently first in commerce, for several reasons, but it is doubtful whether she could have reached her present height if she had not freed herself from private ownership of terminals. As it is, she has a very perplexing problem to find suitable new frontage for public docks for her wonderful traffic.

At Philadelphia and Boston, the other two cities one would naturally expect to be the great ports on the Atlantic coast, conditions were all against water-borne traffic. Philadelphia owned some twenty docks, but most of them had less than nine feet of water.

In theory all her docks were open to the public, but practically they were controlled by private ownership. Boston owned no water-front except a few scattered landings of little importance. Nearly all the docks at Detroit were private property. So were the wharves of Providence—a city well situated for commerce. Duluth owned but a few ferry landings. The water-front at Washington belonged to the United States but was leased to private parties. The largest artificial harbor in the world is at Buffalo, but the frontage was practically all under private control. Chicago, with possibilities of becoming the greatest of lake ports, had almost no public docks and owned no frontage suitable for building them, and her facilities for handling freight were so poor that it was not unusual for boats to carry to Milwaukee goods consigned to Chicago and there ship to destination by rail. New Orleans and San Francisco were the two exceptions to the rule. They alone had instituted public control of terminals, somewhat after the manner of European cities. Montreal was the exception among Canadian ports. Out of fifty of the foremost United States ports only two, New Orleans and San Francisco, have practically complete public ownership and control of their active water frontage; eight have a small degree of control, and forty none at all.

Another essential feature in the solution of transportation problems is generally passed over lightly, as being simply a part of the terminal facilities. It is indeed a part of these facilities, but how important a part will appear from a little study. Before actual transportation begins and after it ends it is necessary to load the goods and then unload them. This is the terminal charge, as the actual haulage is the carrying charge. No data are available to determine this terminal charge exactly. A well-known Chicago engineer, however, with a corps of assistants, has spent a year investigating the subject for commercial interests in Chicago. While his study was not completed and the calculations cannot be relied upon as accurate, they are thought by most freight experts to be approximately correct. They point to the conclusion that on the average railway shipment in this country the terminal expense is equal to 250 miles of haulage and that the terminal charge for the average water shipment would be equivalent to about 2,500 miles of carriage.

These figures need no words to emphasize the fact that the lack of mechanical devices at terminals accounts for the decadence of our waterways or to point out a field worthy of the best trained technical men in the country.

The voyage from Chicago to Buffalo is less than a thousand miles. In a water shipment between these points the actual carriage would be about one-third and the terminal charge two-thirds of the cost. It is this two-thirds that offers opportunity for reduction. The installation of docks and apparatus has in many instances cut the handling costs more than in half. This has been done in the ore, coal and wheat shipments on the Great Lakes. While the terminal charge on miscellaneous freight from Duluth to Cleveland is thought to be about twice the carrying charge, the efficient handling machinery for wheat, ore and coal has so reduced the terminal charge that it just about equals the carrying charge.

If, with these effective devices, half the cost of shipping coal from Cleveland to Duluth consists in loading and unloading, what can be said of the practice on the Mississippi? At St. Louis and Memphis negroes still load the river boats by carrying packages on their heads and reaching the boat by a narrow gang plank. At Vicksburg the only landing is a quagmire of mud.

Quoting Mr. Quick with reference to freight-handling devices, "Where waterways are effectively used, here and abroad, the proper physical equipment of the terminals is taken for granted as an essential element in the business. The handling devices for the grain, ore and coal trades on the Great Lakes are among the commercial wonders of the world; especially the splendid achievement in freight handling by which ore is brought about a thousand miles from Duluth to Pittsburg,—loaded on ships, carried to a terminal on Lake Erie, transshipped to cars, and unloaded at the furnaces at a cost that makes it possible for our steel producers to command the markets of the world. But we have signally failed to solve the problems of handling miscellaneous and package freight on rivers and canals. Water traffic has been decadent because of the hopelessness of its contest with unregulated railway competition; and a decadent industry is apt to give up at all points. But in the new era which we hope for, the commercial interests must adjust themselves to waterway methods of to-day at the best American and European ports, and not to those of the days when Mark Twain piloted the floating palaces on the Mississippi—floating palaces built for passengers and show, and not for the cutting off of the last fraction of a mill in the cost of taking a ton of freight from the bank, carrying it to its destination, and discharging it. . . .

"We have seen how daring is the enterprise of the great foreign ports in the matter of investments in docks, harbor improvements,



Example of terminal equipment. At Erie basin, Buffalo. Three kinds of machine for handling freight are seen — capstans, three-ton cranes traveling on roof and pier rails, and in the far background a package conveyor.



dredging operations, and the like, and how independent the cities are of the general governments. It is quite as instructive to observe how complete is their realization of the necessity for efficient physical equipment for freight handling. Our river cities may well copy these merits. With few exceptions our interior towns that importune the government for the deepening of channels seem destitute of any ideas as to the duties resting on themselves. If the Ohio river towns had done as much for themselves as the government has done for them, every village would have its public dock, every dock would have its warehouse, and every warehouse would have its machinery for transshipment, loading and unloading. The harbor manager would be a greater man than the mayor. The finances of the town would be to the extent of the taxing power at the service of the port. Money would be poured out for better boats than the antiquated craft now plying the river. Every hull would be capable of being thrown open from the top, and cranes capable of doing the work of the uncertain gangs of roustabouts at a fraction of the present expense would handle freight more cheaply than it is handled in the average railway freight house. The railway tracks would be taken out over the water on aerial structures where necessary, and the expensive draying up and down steep levees would be eliminated. At the more important points specialized appliances would be installed, and the town with ambitions toward real cityhood would retain the best engineers for the designing of terminals, to be its proudest achievement, and its greatest municipal undertaking.

"Along all our rivers, lakes and canals the best brains in the technical world must in the future be engaged on the problems of saving this half or two thirds of the expense of transportation which is involved in handling and rehandling of freight. . . . From the public docks the huge packages will be swung by great cranes from the open holds of boats to the cars, and from cars to boats. As an example of the devices sometimes adopted to save time and the breaking of bulk, the methods of sending American meats into London may be cited. They are unloaded from the ships directly into delivery wagons at Southampton, the loaded delivery wagons are carried on cars to London, ready for the horses which haul them to the butchers' shops. In many places trains of cars are carried on boats across rivers and straits, and long distances by water. There seems to be no reason why grain, live stock, cotton, and much heavy freight which is costly to unload, and which must make a part of its trip to market by rail, should

not be carried on boats in the cars — the original shipping packages. Neither does there seem any reason why huge boxes each containing a carload should not be made capable of being swung from the boat to the flat-car to which it might be fitted, and back to the boat again when necessary. The cranes capable of doing the work are already invented, and in use."

The deplorable conditions existing in marine traffic through lack of handling machinery is seen when it is known that the terminal costs at New York and Liverpool exceed the hauling costs of the 3,000-mile voyage. The following picture of the marine situation is illuminating:

"The human worker still reigns practically supreme on the docks in all his primitive wastefulness. . . . He rolls up an annual payroll of millions; he congests traffic by his complex and cumbersome motions. He strikes when he pleases and ties up whole harbors. . . .

"Half the commerce of the nation comes through The Narrows and is distributed from the wharves and piers in the vicinity of Greater New York. It comes in leviathans, but is seized upon by an army of human ants who spread themselves over the docks in a maze of inefficient and costly motion. . . .

"In view of the immense volume of freight loaded and unloaded by . . . vessels every day, the paucity of handling facilities, viewed from the standpoint of modern business management, is almost incomprehensible." *

After this brief review of the general terminal question we can follow with clearer vision the efforts of New York State to rid itself of an incubus which in the past had worked havoc but which under changing modern conditions threatened utter ruin to the canal system unless it should be removed.

The act which nominated the Barge Canal Terminal Commission was written on liberal lines. The needs of the whole state were included in its scope and after the amendment of the following year little was omitted which might conspire to a full understanding of the whole subject. The task set the Commission was this — to quote the language of the law: "It shall be the duty of said commission to visit and inspect the various harbors in this state connected with the canals, as well as all harbors in this state where freight carried on the canals may be either received or discharged. It shall also be the duty of said commission to report to the legis-

* Edward Mott Woolley in January, 1912, *System*.

lature at the earliest possible date, in detail its findings and its recommendations as to the harbors and canal termini, where, in its judgment, special facilities for receiving or discharging canal freight should be provided; as to available sites for such terminal structures; as to the amount of land necessary to be taken at each point for such purposes; also as to the character, extent and probable cost of construction and maintenance of each of such terminal structures; the revenues, if any possible to be derived therefrom; also generally as to matters that, to the commission, may seem pertinent to the subject."

Four State officials were named as constituting this Commission, the four men who would be supposed by virtue of their office to have the welfare of the canals most at heart. These were the State Engineer, Frank M. Williams, the Superintendent of Public Works, Frederick C. Stevens, the chairman of the Advisory Board of Consulting Engineers, Edward A. Bond, and the Special Examiner and Appraiser of Canal Lands, Harvey J. Donaldson. At its first meeting the Commission elected Mr. Williams chairman and at a later meeting it appointed Alexander R. Smith to the position of secretary. Charles S. Sterling served as engineer to the Commission at first but later he was superseded by Charles Kiehm. Two of these men had been members of important former commissions, Mr. Bond (at that time State Engineer) of the Committee on Canals, and Mr. Smith of the New York Commerce Commission. It will be remembered that the Committee on Canals was appointed by Governor Roosevelt in 1899, after the failure of the nine-million project, to study the whole canal question and recommend a State policy, and that the Commerce Commission was named by Governor Black in 1898 to inquire into the causes of the decline and the means for the revival of the commerce of New York.

The Commission attacked its arduous task with vigor and zest. It visited the cities and towns along the canal and also along its connecting natural waterways, both to see existing conditions and to discover the needs. It held many public hearings and the meeting places for these hearings were well scattered along the whole line of the waterways. It accumulated a vast amount of pertinent data and in this phase of the work it was generously aided of course by those who were promoting the claims of their particular localities. The work was too extensive to be finished in the single year first allotted and so the Legislature of 1910 added another year and at the same time made provision for the commissioners to visit Europe and there continue their studies.

The Commission complied with the full mandate of the law and its final report contained not only the required estimates but also plans so carefully worked out that they served as a substantial basis for contract plans after the building of the terminals had been ordered by the State. Its report in fact was so complete and embodied so much of value on the whole study of terminals, both home and foreign, that it at once took a high place among the books of its class. If the term may be applied to technical subjects, it is scarcely stretching a point to call it a classic on waterway terminals. We shall turn to a somewhat detailed study of this report in a moment.

There was one phase of the terminal question, however,—that of grain elevators—which the Commission little more than touched upon. This was not due to lack of appreciation of the importance of elevators but rather to want of time to give the subject as thorough investigation as it deserved, and so the Commission had to content itself with recommending further investigation. When we come in proper sequence to look into this subject we shall see how very important a part of New York canals adequate elevators are. The reason for this condition is that the canals through New York state are, according to the claims of their friends, the rational outlet to the great grain belt of North America, a belt having an area of a million and a quarter square miles, a population of thirty millions of people and a production of five billion bushels annually.

The three chief American reports on water terminals appeared at about the same time and in rapid succession. In 1910 a volume on the subject was published as the last of three volumes covering an exhaustive study of transportation by water in the United States, made under Herbert Knox Smith, United States Commissioner of Corporations, of the Department of Commerce and Labor. This third volume was devoted to the subject of terminals. Then in 1911 the final report of the Barge Canal Terminal Commission appeared, following a brief preliminary report of 1910. In 1912 the United States National Waterways Commission made its final report. We have already quoted from this work. It too followed a preliminary report, submitted early in 1910.

Obviously the time was ripe for the New York Commission to do its work and for terminal advocates to attain their end. The enlarging of the canals had been in progress now for several years and if terminals were to be added their commencement could not be delayed much longer without danger of not having them finished

when the channel should be ready for navigation. On the other hand, to have begun them much sooner would not have been wise. The people had voted an immense sum for improving their canals and seemingly they were in complaisant mood for completing the job thoroughly. Waterway agitation was rife throughout the eastern and middle states. The report of the Terminal Commission, when it came, contained illuminating data in abundance and its arguments for terminals were evidently convincing. But aside from this report, for most of the people of the state never saw it, there appeared to be abroad among a majority of the folk at least a meager appreciation of that which had become so obvious in Europe as to need no argument and which was gradually but surely gaining credence here, namely, that canals of necessity must have adequate and publicly-controlled terminal facilities. Doubtless the researches of the three National or State commissions, operating directly or through magazine articles and press editorials which they induced, were responsible for this molding of public opinion. When the question came to popular vote on the New York canals there was no strenuous contest, such as the days of 1903 had witnessed. It seemed almost as if the friends of the canals were so sure of victory that they deemed it of little importance to bestir themselves. It is noteworthy, moreover, that of several referenda submitted to the people in 1911 that for canal terminals was the only one to receive approval.

But we have not yet stopped to inquire what a canal terminal is. The varying conditions of different kinds of traffic introduce many minor factors which go to make up satisfactory terminals, but in general there are only a few fundamental requirements for all waterway terminals. The Commissioner of Corporations in his report gave this number as four and even one of these might on occasion have to be dispensed with. We may well adopt his classification. These four essentials are: (a) Good wharves, (b) warehouses and storage facilities, (c) mechanical appliances for the handling or transshipping of freight, and (d)—that which is highly important though not always practicable—belt-line railway connections with adjacent railroads and industrial concerns, so as to coördinate water with rail transportation and with local production and distribution. Sufficient depth of water of course is also necessary, but this is a feature of the channel rather than the terminal problem.

We are not now making an exhaustive study of the terminal question and so we need not delve too deeply into the wealth of

material contained in the Terminal Commission's report, but there are a few statements in it, aside from the estimates and recommendations, which we should know; they illumine both the terminal and the general canal problems. We shall mention them before we give the estimates and recommendations.

A study which the Commission made of existing and past canal traffic showed that the local freight being carried on the State canals was several times as great as the amount of through freight. Also that for a long period, at least forty years, the annual tonnage of local freight had remained almost a fixed quantity, while the through freight had dropped to one-fifth of what it was forty years earlier and only one-sixth of what it was thirty years earlier. Both of these facts were rather surprising in the light of popular belief. Somehow the people of the state had come to regard the canal as of little local value and moreover of use chiefly to carry cargoes which simply passed through the state from lakes to ocean. This revelation of both the preponderance and the stability of local traffic was well calculated to cheer the citizens of the state and also it proclaimed the need for terminals at the various inland canal towns.

There was a further study, moreover, which disclosed facts that might measurably fortify whatever feeling of satisfaction the people had. This was a study to ascertain how many tons of commodities suitable for canal traffic were produced in the mills and factories of the towns which were situated on the Barge canal. In making this compilation only such products were included as were generally carried in bulk and for which rapidity of passage was not an important factor. A total of a little more than ten and a half million tons was shown, valued at well over two hundred million dollars.

We recall that the law authorizing the canal had fixed its carrying capacity by stipulating that the supply of water for the Erie branch should be sufficient for at least ten million tons annually. By a strange coincidence this study showed that there were produced, virtually upon the canal banks, this very amount of commodities which properly should be shipped by canal. The people of the state thus had it in their power to become themselves the recipients of the full beneficence originally planned for the canal, without leaving room for outsiders to enjoy the State's generosity. The total capacity of the canal, however, it may be added, is actually close to twenty million tons. The facts revealed by this study may have had some weight in deciding the popular vote on

the terminals, but doubtless they have been forgotten long since by most persons, for those most intimately concerned have not yet made large use of the completed canal.

The decline in the amount of freight carried on the canals was well known, but that this falling off was entirely in the through freight was a fact that perhaps had not been fully realized until this study was made by the Terminal Commission. The decline was attributed by the Commission largely to the lack of independent terminal facilities at Buffalo and New York and to the increasing control by the railroads of terminals not only at Buffalo but also throughout the Great Lakes region. A contributing cause was one which we have not yet mentioned but which has been responsible for much of the failure of waterways to get their due share of traffic. This was the refusal by railroads to prorate on through routes where freight would naturally go part way by rail and part way by water. This of course is but a piece of the generally hostile attitude railroads have assumed toward all canals and canal boat lines not their own. In 1917 the New York Legislature enacted a law aimed at the correction of this condition — an act to regulate joint rail and water routes.

This subject of the relationship between railroads and waterways contains many phases besides the one just mentioned and is a most important topic, but we shall leave the full discussion for a later chapter. We may just add a sentence or two. Speaking of the refusal of railroads to prorate with water carriers, the National Waterways Commission says, "In many cases the route, which apparently is the natural one, would be by water for three-fourths or more of this distance, yet the charge for the remaining railway haul is so considerable as to render carriage for the longer haul by water unprofitable." Viewing the subject from a slightly different angle, the Terminal Commission says, "The railroads have always refused to either prorate or through-rate with canal carriers but, on the contrary, have only been willing to receive freight brought to them by canal boats in the most unusual and expensive manner, such as by forcing them to discharge their freight at places other than railroad wharves, and then team it to the railroad wharves, instead of allowing them to come directly to the railroad wharves, and there discharge their freight. By refusing, on the other hand, to deliver freight to canal boats at their wharves, they have been able to prevent them from carrying large quantities of freight that would otherwise have been shipped by the canals."

In amplification of the first explanation we mentioned for the falling off of through freight, namely, the lack of terminal facilities at Buffalo and New York, the Terminal Commission says:

"This subject of terminals was considered at some length by the New York State Commerce Commission, in its report made to the Legislature, on January 25, 1900, and all that that Commission then said may be as aptly repeated at this time as then.

"Upon the suggestion of Governor Roosevelt, the members of that Commission went to Chicago, St. Paul, Minneapolis and Duluth, and there interviewed the larger shippers, particularly those who shipped flour and packing house products east, and the statements made by these western merchants is most illuminating as to the reasons why such commodities are no longer shipped for export via the port of New York, the chief reason advanced being that there were no places in Buffalo affording independent terminal facilities. We quote from the statements of that State Commission of eleven years ago, in part, as follows:

"'Agents of the great flour mills, who ship annually millions of barrels of flour to Europe, who appeared before this Commission in New York, and the officials of the mills in Minneapolis and in Duluth all united in the statement that lack of canal terminal facilities for package freight alone prevents flour coming to New York by way of the canal, which is now sent to the outports.'

"Again we quote from the report of the New York Commerce Commission:

"'Agents of the great provision merchants of Chicago have also made clear to this commission their inability to use the canal for their business because of the lack of canal terminals.'"

When the Terminal Commission came to make its recommendations, much stress was laid on the need of adequate facilities at New York city. Why this metropolitan district was entitled to so much consideration and why so large a share of the appropriation eventually fell to its lot, we may understand perhaps by listening to what the Commission has to say relative to the volume, the growth and the importance of traffic in the port of New York and also the insufficiency of its facilities for handling that traffic. Precise information on the volume was not available but several trustworthy estimates had been made and these did not differ widely. The Commission was confident that at least half of all water-borne traffic of the United States centered in this harbor, and the total tonnage in the nation, as reported in a Federal document which had

been prepared with great care from the almost unlimited official data, was 256,000,000 tons per annum.

Speaking of the growth of foreign commerce in the port of New York, the Commission states that between 1880 and 1898 there was no increase, and then, after mentioning the succeeding rapid increase and the relatively small increase in wharfage accommodations, pertinently asks the question, "If, at the end of a period of stagnation in the growth of New York's foreign commerce, extending over eighteen years, there was such a serious lack of sufficient wharfage as to force steamship lines to other ports to secure the accommodations they required, as testified by the president of the dock board in 1899, what can the condition be now, twelve years later, when there has been an increase of 87 per cent in the foreign commerce of the port, as well as a very large increase in the coastwise and local traffic besides? With but 23 per cent of increased wharfage during that period, inclusive of the very large and costly works to which we have referred above, manifestly the congestion of traffic along the most desirable and most useful waterfront of the city of New York must at the present time be acute, and extremely ominous."

The port of New York, in its foreign trade, its coastwise trade and its local harbor traffic, stands without a rival in America. But greater still, it outranks all other ports of the world in the volume and the value of its commerce. Several things have conspired to this end—its priceless and ample natural harbor, its admirable arrangement of land areas surrounded and divided by deep water channels, its preëminence as the metropolis of the western hemisphere, and more than all, perhaps, its situation at the outlet of Nature's gateway to a vast interior, a gateway through the only practicable route in United States territory for a waterway and the best route for a railway from the Great Lakes to the Atlantic coast, a sort of "Northwest Passage" to the heart of the continent.

We remember in this connection that the original Erie canal had much to do with making New York the chief American port in the early days and thus in giving it an initial upward trend which enabled it to continue in its success and to retain its proud estate. Moreover, we recall that before the canal was built New York had not been the first port of the land, that before that time it had even been among the more backward of the colonial ports.

It is when New York is compared with other ports of the United States that its glory is brightest, its preëminence most conspicuous, its claim to leadership unapproachable. But on the other hand, if

it were to retain its lead in the world and keep ahead of its great rivals in Europe, the need for better facilities and a larger growth could not be neglected.

New York is not well situated for any general railroad occupancy; its insularity precludes that. But this very isolation, aided by favorable configuration between various parts of the greater city, is a boon to water-borne traffic. If the New Jersey shore opposite New York city is considered as a part of the port of New York, then there is in this port a total water frontage on rivers, bay, sound and ocean of 444 miles. But until recent years there has been no inclination to regard this as a single port. Political boundaries have held taut; the two States have each had their separate methods and machinery of control and the result has been contention and hostility. Nature made this one incomparable port; man has striven to defeat the intent of Nature. But this old-time stupidity is now passing and it seems probable the present efforts for harmonious, united control will soon be in such complete working order as to carry out some comprehensive and already partially perfected plans for improvements that will increase abundantly the facilities so sorely needed. This is a subject by itself, however, and considerably later in occurrence than the terminal agitation. It should not be injected into the present discussion. In due time we shall recur to it.

We have been considering general traffic conditions in New York harbor. The whole picture of inadequate facilities is cheerless enough, but when we turn to view the accommodations afforded canal shipping it becomes so dark as to be utterly doleful, and the wonder grows that the canals could have continued even to do any business whatsoever against such overpowering odds. To quote the Terminal Commission: "In New York city there has never been any section of the improved waterfront, not even at the so-called canal basins, or canal districts, where there were any facilities, other than the unshedded wharves, for the accommodation of freight destined for shipment over the canals, or for freight received from the canals. There has, even at such open wharves, been no one to receive and care for any freight that might be received either for shipment over the canals, or that might be received at them by canal boats for local use. Lacking these essentials to the modern handling and carriage of freight it was inevitable that the through business should have almost vanished."

The Commission goes on to cite a single exception to this condition. In the case of certain commodities which could not bear

railroad rates the agents for the railroads would contract for shipping this freight as far as Buffalo by canal, and thus there came into existence what, in the parlance of the canal world, were known as "canal lines." These were not lines at all, but were individually-owned boats, chartered intermittently by the railroads. As canal boats had to be sufficiently loaded to pass under the bridges, owners were usually glad to charter their craft and generally the railroad agents were able to drive a hard bargain on west-bound cargoes. But boats had then become few and these canal lines, once the fictitious property of the railroads, had almost disappeared.

New York city's neglect of canal interests and its disposition to do as little as possible for the accommodation of canal shipping were notorious. Indeed, so pronounced were they that it would seem that the city deserved but little consideration from the State in the matter of terminals. By legislative direction two places on Manhattan had been reserved in part for the benefit of canal boats, but these places were without sheds or other facilities and only so much had been done by the city as was necessary to conform to the mere letter rather than the spirit of the law. But this attitude of intentional neglect was chargeable to former city administrations, which had regarded the water-front almost wholly as a means for increasing municipal revenues, rather than to the public in general and moreover this attitude was changing. Because of this former maladministration, however, the Terminal Commission advised that any terminals erected by the State in the city of New York should not be put under the control of the city authorities.

If New York city had been at fault in neglecting canal accommodations, the other cities and towns of the state had done little better. In none of them had there been even a semblance of a policy or system adopted for the improvement or development of its water-front. On the contrary these municipalities had permitted private interests—chiefly railroads—to acquire the choicest water-front properties, much to the embarrassment of water carriers and in no degree helpful to the promotion of water-borne commerce.

What the Terminal Commission said concerning the relationship existing between railroads and waterways in Europe is worth noting. In all countries except Great Britain and southern France there seemed to be a general and complete interchange of freight between rail and water lines, transfers being made directly between cars and barges, at a minimum of expense and a maximum of speed. The result of this fair dealing between the two systems showed conclusively that the railroads were quite as great benefi-

ciaries of such relations as were the water routes. The railroads were not compelled to spend their money in roadbeds and equipment for handling great quantities of heavy, low-grade, low-priced materials, which paid but little in freight charges, but could devote their equipment and their development to accommodating the higher-priced commodities, that paid better rates, and to transporting passengers, thus being able to pay large dividends on the capital invested.

Another noteworthy observation made by the Commission while in Europe was that there prevailed in those countries a belief, seemingly everywhere accepted as sound, that in waterways complete efficiency was the chief objective and expense a secondary consideration, also that the general good and the material advancement of State and city were immeasurably more to be sought after than direct financial returns sufficient to replace the moneys expended, and that these indirect benefits were so substantial as fully to justify a continuance of improvements and an enlargement of facilities, although the money sunk in them might never be directly returned to the states and municipalities advancing it. Indeed, it was seen that at many harbors the authorities did not expect to recover all that was expended annually even in maintenance and administration, contenting themselves with the indirect and satisfying benefits following in the wake of cheap transportation.

In connection with this thought we desire to emulate the Terminal Commission in calling attention to New York State's generous canal policy, which is in exact accord with the advanced ideas reached in Europe after many years of experience. In 1882, after more than sixty years of canal tolls, which had actually returned to the public treasury several millions more than the canals had cost in building and maintenance, the State opened its waterways free for the use of all without tolls or dues of any kind. And within two years after the tolls had been abolished the State commenced enlarging its canal locks and this was but the beginning of a series of improvements which have continued virtually to the present day and which have been gigantic beyond even the dream of anything that had gone before. And in all of these enormous expenditures since 1882 there has been no possibility of direct return. It would seem that in this willingness to spend their millions, which will be repaid only in the coin of general welfare, we can read nothing other than the belief of the people of the state in their canals. And this belief has been attested repeatedly. First the canals were freed from tolls by an overwhelming major-

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Terminal at Rochester. Two freight-houses are shown, a substantial brick structure, 400 feet by 50 feet in size, and a much smaller frame house. The two cranes are two-ton electric traveling roof cranes of trolley type.

ity; at each succeeding improvement authority for new expenditures has been voted without stint; on several occasions, and always by large majorities, the Constitutional dictum has been reaffirmed that the canals shall not be sold but "shall remain the property of the State and under its management forever." Evidently the people, whenever they are required to think deeply on the subject, deem their canals a mighty force in their hands and consider that they may use this force for controlling rates and bettering transportation, greatly to the benefit of all and for the advancement of the public good.

Before giving the recommendations of the Terminal Commission we desire to pause long enough to enumerate the ports inspected in Europe by the commissioners. They visited Great Britain, France, Belgium, Holland and Germany. Their report contains a painstaking general study of terminal conditions and growth of traffic in each of these countries and also detailed descriptions, often accompanied by maps, of the principal ports. All but one or two of these ports they visited in person and the list includes London, Liverpool, Manchester, Leeds, Goole and Glasgow in Great Britain; Rouen and Paris in France; Brussels and Antwerp in Belgium; Amsterdam and Rotterdam in Holland, and Cologne, Düsseldorf, Duisburg-Ruhrort, Dortmund, Mannheim, Strassburg, Kehl, Frankfurt-on-Main, Berlin, Hamburg, Bremen, Kosel and Breslau in Germany.

In its final report the Terminal Commission recommended that the State appropriate sixteen and a half million dollars for constructing and equipping public terminals for the Barge canal. The cities it designated as the places for such terminals were Buffalo, the Tonawandas, Rochester, Syracuse, Oswego, Utica, Schenectady, Whitehall, Troy (two terminals), Albany and New York. For New York thirteen terminals were advised, at the following sites: Spuyten Duyvil, West 135th street, West 78th street, West 51st to 54th streets, Gansevoort street, Vestry street, Canal basin on East river, Grand street, Sherman creek, Mott Haven, East 136th street, Newtown creek and Gowanus bay. The Commission had studied the peculiar needs at each of these places and had made plans to suit the requirements for each proposed terminal. In its recommendations the number and length of piers or dockwalls, the amount of land required, the size of storehouse, the kind of freight-handling machinery and other like details of construction were named and an estimate of cost given, but these particulars do not

concern us except to show the minute care with which the investigation was carried out. The total of the estimates submitted for the cost of each terminal was \$166,408,315. This included an item of \$600,000 for terminals at the smaller cities and towns, not specifically named. The estimate of annual expense for maintaining all of these terminals was \$120,413.

The Commission made fifteen further recommendations, all of which were important and had a more or less direct bearing on several phases of the terminal and general canal problems of the state.

These were succinctly put and we quote the words of the report as follows:

"1. Plans for terminal structures should be prepared by the State Engineer and Surveyor and their construction carried out under his direction when such plans have the approval of the Canal Board.

"2. The terminals should be administered under the direction of the State Superintendent of Public Works.

"3. Charges for use of terminal facilities should be fixed by schedule established by the authority having the terminals in charge, when approved by the Canal Board.

"4. The Federal Government should be urged to undertake the straightening of the Harlem Ship canal at the Johnson Iron works at the earliest possible moment. The State, the city of New York and the borough of the Bronx should co-operate in securing the necessary right of way.

"5. The Federal Government should be urged to improve the Bronx kills to a depth of at least fifteen feet at mean low tide.

"6. The city of New York should clear the unnecessary obstruction to navigation in the Harlem river by removing from the channel the piers of High bridge.

"7. The State should retain title to all its lands under water and to all canal lands except such as it may advantageously exchange for other lands better adapted for canal or terminal purposes. Any private occupation of State-owned lands should be by lease for a definite term, except such as border directly upon the canals, in which case leases should be revokable at the pleasure of the Superintendent of Public Works. Private occupation of State-owned lands should yield a reasonable revenue to the State.

"8. The title to all water power created incidental to the construction of the Barge canal should be held by the State and such power leased for terms of reasonable length.

"9. Legislative authority should be given to each municipality located on a lake or river to control the development of its waterfront by reasonable regulations regarding erection of bulkheads, piers and other structures.

"10. The city of New York should reconvey to the State a section of the land under water in Jamaica bay for terminal purposes to be selected when the improvement of the bay makes it available.

"11. The State Engineer should be directed to make an accurate survey of the suggested canal to connect Jamaica and Flushing bays, and the necessary appropriation for the expense thereof should be made.

"12. The bridges yet to be built in connection with Barge canal construction on the Oswego and Seneca rivers between Lake Ontario and Onondaga lake should be so constructed as to be readily convertible without unnecessary expense from a fixed to a movable type.

"13. A commission composed of representatives of the leading commercial organizations in different parts of the State should investigate conditions affecting interchange of freight, the subject of prorating and through-rating, the recognition of through bills of lading and of low through-rates at points of interchange, as between water and rail carriers, also the relation of the grain elevators, fixed and floating, to rail and water carriers, in this State.

"14. The Legislature should direct the State Attorney-General to participate in behalf of the State in the proceedings before the Interstate Commerce Commission for the abolition of the differential on freight from Chicago to New York and vice versa.

"15. Some competent authority should be designated to make a study of the various types of barges with a view of recommending that type which is best suited to the enlarged canals." *

There was no long interim between the presentation of this report and the carrying out of its main recommendation. The report was transmitted on March 1, 1911, and before the session of the Legislature which received it came to an end an act had been passed authorizing the construction of canal terminals. Response to some of the minor recommendations was incorporated in the terminal act but others were not so quick to receive attention. We shall see later how the State eventually paid heed to some of

* Volume I, pp. 178-180.

the latter class, how a board of conference was named to devise means for promoting the projects which involved the straightening of the Harlem at the Johnson iron works, the deepening of the Bronx kills and the removal of obstructions at High bridge, how the State Engineer was directed to survey the Jamaica-Flushing route, how adjustment of the relationships between rail and water carriers was attempted by legislative act, how provision was made for building some of the needed grain elevators and how a commission on Barge canal operation was instructed to report on the type of boat best suited to navigate the new canal. The discussion of these subjects will come in due course. We have anticipated the action on the Oswego canal bridge problem and already have described the result of this recommendation.

With the filing of this report the Terminal Commission went out of existence. There had been a political turnover in State administrative affairs at the beginning of 1911 and two members of the Commission, Mr. Williams and Mr. Stevens, had been superseded by new incumbents in their respective offices of State Engineer and Superintendent of Public Works. But the pushing of terminal agitation was taken up by canal advocates. At the call of State Waterways Association officials, representatives assembled at Albany from the leading municipalities throughout the state at what was termed a Barge Canal Terminal Conference and the result was the drafting of a bill and its introduction in the Legislature. Numerous towns which had not been mentioned specifically in the Commission's recommendations grasped their opportunity and secured their inclusion in the drafted bill, some of them having employed engineers meantime to prepare tentative plans and estimates.

The act carried an appropriation of \$19,800,000 and so, of course, by reason of the constitutional inhibition to vote more than one million dollars without approval by the people at a general election, it became a referendum in the fall of 1911. No very marked opposition to the measure arose and there was no especially aggressive campaign in its favor. In general public sentiment seemed to accept as sound the argument that inasmuch as a vast sum was being spent to modernize the canals it was well to increase the amount by the few other millions needed to make the original expenditure completely effective. But the small majority in its favor, only 4,416, and the large degree of apathy displayed (more than half a million blank votes) taught canal advocates to bestir themselves when their next proposition came before the people.

Before we consider what the terminal act authorized and also in order that we may know just what things were to be provided under the law, it may be well to see how the act defined the word terminal, what it presumed to include in this rather broad term. Section one of the law reads, "The words 'terminal' and 'terminals' as used in this act shall mean and include lands, docks, dock walls, bulkheads, wharves, piers, slips, basins, harbors, structures, tracks, facilities and equipment for loading and unloading and temporarily storing freight transported upon the Barge canals of this State."

The law stipulated definitely where the terminals should be built and fixed with considerable detail the character and the extent of construction at each locality. It also set apart a given sum which might be expended in building each terminal. The places specified in the act included Erie basin and Ohio basin at Buffalo, North Tonawanda, Tonawanda, Rochester, Lyons, Syracuse, Oswego, Utica, Rome, Troy (two sites), Albany and fourteen localities in New York city, as follows: Port of Call near Dyckman street, West 135th street, West 78th street, West 53d street, Gansevoort street, Vestry street, Piers 5 and 6 on East river, Piers 4 and 7 on East river, Broome and Grand streets, Sherman creek, 150th street on Harlem river, East 136th street, Newtown creek and Gowanus bay. At each of these prospective terminals the details of construction and the amount of money to be spent were set forth in the act, except that the allotment for New York city was named as a lump sum. The law further provided terminals for Lockport, Herkimer, Little Falls, Fort Plain, Canajoharie, Schenectady, Rouses Point, Port Henry, Plattsburg, Whitehall and Mechanicville and appropriated a certain amount of money for each, but it did not specify any details of plan. Then it contained another list, which included Amsterdam, Fultonville, Clyde, Palatine Bridge, Port Gibson, St. Johnsville, Constantia, Waterloo, Newark, Palmyra, Fairport, Ilion, Spencerport, Brockport, Holley, Albion, Frankfort, Medina, Cohoes, Waterford, Fort Edward, Seneca Falls, Ithaca, and Geneva, at which places terminals might be built if certain conditions as to filing petitions by local officials and citizens were complied with and if thereafter certain designated canal officials upon due investigation were in favor of granting the petitions. Inclusion in this last list really availed these particular localities nothing, however, since the same privilege of petition was accorded any other place for which no specific terminal provision was made in the law. One other terminal location was mentioned —

Jamaica bay—but nothing was to be done here until the Legislature should make special appropriation for the work.

In matters of general procedure the law made substantially the same provisions as those under which the canal was being built. As we have seen in our former study the Barge canal act contained a few rather bold innovations as to the manner of awarding contracts and prosecuting contract work. These had been found to work well and were repeated in the terminal law. The Canal Board, as in general canal affairs, was the supreme governing body. The State Engineer was to make the plans and supervise the construction. The Superintendent of Public Works was to operate and maintain the terminals after their completion. The making of rules and regulations to govern the use of the terminals devolved upon the Canal Board.

The framers of the law foresaw the danger of individuals or corporations trying to monopolize the terminals and therefore careful provision was made to prevent the success of any such attempt. The use of the terminals was to be restricted to such reasonable time as was necessary for the transshipment of goods and any privilege of occupancy was at any and all times to be revokable by the Canal Board. As specifically stated in the law the terminals were to remain the property of the State and be under its management and control forever. The law in this particular reads as follows:

“The terminals provided for in this act when constructed shall be and remain the property of the State, and all of said terminals, including docks, locks, dams, bridges and machinery, shall be operated by it and shall remain under its management and control forever. None of such terminals or any part of any such terminals shall be sold, leased or otherwise disposed of, nor shall they be neglected or allowed to fall into decay or disuse, but they shall be maintained for, and they shall not for any purpose whatsoever be in any manner or degree diverted from the uses for which they are by this act created.”

In choosing sites and making plans for terminals the State Engineer was granted liberal discretion by the law. His general policy of construction was first to provide two things—the necessary depth of water in harbor or slips and the terminal land area with its accompanying dockwall and piers. These he followed with warehouses, paving, tracks and the like, and finally he added freight-handling machinery. The wisdom of this order and also of a

certain deliberateness of procedure, which has characterized the whole terminal work, will be obvious on a little thought. New sections of completed channel were being opened for navigation every year and by following this policy there were appearing along with these sections terminals which, though perhaps lacking storehouse and handling facilities, still were available for use. Also as the canal came into greater general use there was opportunity to learn by experience what kind of traffic was being developed at the several localities. This knowledge was essential, for the records of the old canal gave little indication of what might be expected of the new canal, and the kind of traffic, of course, would determine what type of machinery should be provided.

We do not propose to follow now the course of terminal construction, but an enumeration of all the terminals which have been built seems in order at the present time. In the first of the following two lists there are mentioned fifty-six localities. These are the places where terminals have been built with money appropriated by the terminal law, although at a few of them vertical walls built in channel construction were utilized for terminal dockwalls. This list contains terminals of various kinds, all the way from the elaborate creations in New York harbor, where immense sheds on long piers are crowded daily with goods which are handled by the latest type of electrically-operated device or even where a two-million-bushel grain elevator with all its intricate parts is being erected, to the simple structure at some small hamlet, where the whole equipment consists of nothing more than a wall at which boats may land, a leveled area back of it and a humble frame storehouse, and even the storehouse may sometimes be lacking. With but one or two exceptions, where work has been halted for some reason, this list enumerates the places where efficient terminals have now been built.

Arranged in topographic order, beginning at the Lake Erie end, the list runs as follows: Buffalo (Ohio basin), Buffalo (Erie basin), Tonawanda, North Tonawanda, Lockport (upper terminal), Lockport (lower terminal), Middleport, Medina, Albion, Holley, Brockport, Spencerport, Rochester, Newark, Lyons, Ithaca, Weedsport, Syracuse, Oswego (river terminal), Oswego (lake terminal), Constantia, Cleveland, Rome, Utica, Frankfort, Ilion, Herkimer, Little Falls, St. Johnsville, Fort Plain, Canajoharie, Fonda, Amsterdam, Schenectady, Crescent, Cohoes, Troy (upper terminal), Troy (lower terminal), Albany, Mechanicville, Schuylerville, Thom-

son, Fort Edward, Whitehall, Port Henry, Plattsburg, Rouses Point and the following in New York: West 53d street, Pier 5 (East river), Pier 6 (East river), Gowanus bay, Greenpoint, Long Island City, Hallets Cove, Mott Haven and Flushing.

The second list contains eight names. These are the places where terminals exist by virtue of walls built under the Barge canal act, none of the terminal funds having been devoted to them. They are Pittsford, Fairport, Palmyra, Seneca Falls, Baldwinsville, Fulton, Brewerton and Waterford. The whole number of terminals, it thus appears, is sixty-four. Few towns of size along the canal are without some terminal facilities.

The adding of terminals to the canal project had been delayed so long after the beginning of the canal itself that speed in the new venture was essential. Accordingly, as soon as the result of the official canvass of votes was known, on December 13, 1911, State Engineer Bensel appointed an engineer to take general charge of this work. The appointee was John A. O'Connor, who was elevated from the position of Division Engineer of the Eastern division, and his new title was Terminal Engineer.

Speed was made also in beginning the work of construction. By August of the following year the first contracts were awarded and before the year closed terminal work at Ithaca, Albany, Little Falls, Mechanicville, Whitehall, Fort Edward, Schenectady, Herkimer, Fonda, Ilion, Amsterdam, Rome and Lockport was under contract. Location plans for a dozen more terminals had received the Canal Board's approval and the work of preparing plans for them was under way or in some cases was completed. It had been found advisable to study local needs quite carefully before beginning the preparation of plans. The State Engineer conducted hearings at towns where terminals were to be built and through these consultations he got the local points of view concerning both the best sites and the existing and prospective traffic requirements. As we have seen, the terminal act in a broad sense fixed the locations and described the character of construction, but exact sites and definite details were left to later determination. The State Engineer and the Superintendent of Public Works decided as to sites, their decision being subject to the approval of the Canal Board. The contract plans were worked out with careful study in the State Engineer's department and then were submitted to the Canal Board for approval.

In his annual report for 1912 the State Engineer called attention to the omission of an important section of the state from participation in the terminal project. No cities or villages on the Hudson river between Albany and New York had been included. To be sure the Hudson river below Albany had never been looked upon by either officials or the public as really a part of the State waterway system, but there was no logical reason for this view and under the new order, wherein the larger portions of the old-time canals were themselves river canalizations, the last vestige of reason for excluding the Hudson river from the State system was gone. Then too New York was a Hudson river city and it had received a very generous portion, almost half in fact, of the terminal allotment. The State Engineer did well therefore in suggesting that this omission be righted.

Since this particular part of our study has to do chiefly with the account of terminal agitation and authorization rather than the record of construction, we may with propriety at the present juncture follow the fortunes of these canal terminals for Hudson river towns. Although the State Engineer had made his suggestion in 1912, it was 1918 before the Legislature took the first step in response. In his report for 1915, however, State Engineer Williams, in discussing the question of finances in connection with terminal construction, said that at certain places the development contemplated by the act could be accomplished for less than the amounts set apart for those places and recommended legislative action to permit the using of these balances for other terminals and in his opinion some of the cities along the Hudson might well be chosen for this purpose. The Legislature of 1918 (by chapter 555) ordered the construction of canal terminals at four Hudson river cities, Poughkeepsie, Kingston, Newburgh and Yonkers, but aside from a sum for making surveys and plans it provided funds simply for the purchase of the necessary sites. Surveys of the lands were made without delay and within about a year titles had been acquired by the State. Then the State Engineer proceeded to make studies and preliminary plans, but further money has not been forthcoming and there the matter has rested, except that each year State Engineer Williams has reminded the Legislature that in effect the State has pledged itself to the construction of these four terminals and the time was at hand for the fulfillment of that pledge. But in the disturbed financial conditions and in the business depression throughout both the state and the nation subsequent to the World war there may be found ample reason for failure

to appropriate moneys for this and all other projects which are not absolutely essential. Petitions have been received for terminals at three other Hudson river cities, Beacon, Hudson and Rensselaer, and preliminary studies have been made for the sites of such terminals. Mr. Williams has recommended that the Legislature include these places also in whatever appropriations are made for terminals along the Hudson.

There has been a strong organization, it should be added, working for these river terminals. This is known as the Hudson Valley Federation and it comprises an aggregation of allied commercial organizations from Troy to Yonkers, numbering ten thousand in their membership. This federation had been back of the 1918 legislation. At first \$950,000 had been asked for, a sum supposedly sufficient for both acquiring the sites and constructing the four terminals. At a hearing before the legislative reference committee it was suggested that, because of war exigencies and other demands for State funds, the amount be cut to \$160,000, of which ten thousand should be for surveys and plans and the remainder for securing the sites. This was agreed to and the measure was passed. In 1919 a bill appropriating \$350,000 to begin construction went through the Legislature but was vetoed by the Governor on the ground that it should be provided for by bond issue. But this procedure was the very thing the advocates of the project had tried to avoid, having kept even their original request below the million-dollar constitutional limitation.

When the Terminal Commission made its report it included among its list of recommendations one that a commission composed of representatives of leading commercial organizations of the state be appointed to investigate certain conditions, one of them being the relations between elevators, fixed and floating, and the rail and water carriers. Such a commission has not been appointed, but the end in view has been attained in another way.

The Terminal Commission had not included the subject of elevators among its investigations because, as it reported, there had not been time to study properly this phase of the terminal question. But those who have had to do with the building of our canal terminals came to see, and as time passed the conviction grew stronger, that one of the most pressing needs of the day was that of grain-handling facilities, and also that eventually the State must include elevators in its waterway scheme if the canals were to get anything like their proportionate share of what should be, in the nature of things, their chief article of freight.

The logical points for transferring grain cargoes carried by canal were Buffalo and New York. Buffalo was supplied with several elevators, although canal boatmen found difficulty in securing the privilege of using them, but New York had almost no elevator facilities, virtually none available for canal use. The greatest need for a State-controlled elevator, therefore, was in New York harbor and in choosing the locations for terminals in the metropolis one very fortunate selection for this purpose had been made. But at the time of selecting this site the question of elevators had not come prominently to the fore and so it was not the controlling factor in the choice. At Gowanus bay a terminal has been built which is especially designed to serve as the chief point of contact between ocean and canal traffic. Here originally was a considerable area of low land which might be reclaimed and here also a depth sufficient for sea-going vessels had to be dredged. The cheapest way of disposing of the spoil was to pump it behind a bulkhead wall and thus the State Engineer turned expediency to greatest account and paved the way for what he hoped would follow. What has followed has been the utilization of this favorable site for a large elevator, but there is still ample room on this made upland for the purposes which the Terminal Commission had in mind for this place — extensive warehouses and a railroad classification yard.

From time to time the need of a canal elevator at New York was given public utterance in press or speech but never very seriously until soon after the entrance of the United States into the World war. Then the attention of Federal officials was called to the availability of the Gowanus bay terminal as the site for an elevator to be used in shipping overseas to our own expeditionary forces and to our allies the millions of bushels of grain which it seemed probable our Government would be called upon to send. Moreover, the State offered so to construct the pier then in process of building that, without interfering with its usefulness for general cargo-handling, it could also serve as a part of a 10,000,000-bushel elevator, such a structure being easily possible on the site, should the United States decide to build it. This suggestion came to naught, however. The United States had not determined to undertake the project by the time hostilities ceased.

Meantime, of course, no strong efforts were made to induce the State to move in this matter, but the subject was occasionally brought to public attention. This was done through press articles, at waterway conventions or by public officials. In his report to the Legislature of 1919, State Engineer Williams said that, if the

canal were to take a leading part in the carrying of grain, an elevator suitable to canal needs must be erected in New York harbor. He reminded the members that neither the Barge canal law nor the terminal law made any provision for elevators and that it was incumbent upon them to determine the State's policy in this respect, since private enterprise could scarcely be expected to act in view of the uncertainty of the State's position. He added that the State was already in possession of an area large enough for any reasonable elevator development and that a pier then being constructed at this locality had been planned to accommodate the grain-carrying portions of an elevator system without the strengthening of its foundations.

During the 1920 legislative session this matter came to a head. First Governor Smith in his annual message at the opening of the session made a strong appeal for three canal elevators — at Buffalo, Oswego and New York. This was followed by yet stronger appeals from State Engineer Williams and Superintendent of Public Works Walsh in their annual reports to the same Legislature. The result of these recommendations, reinforced by the aggressive support of canal advocates, was the passage of an act (chapter 698, Laws of 1920) authorizing the construction of grain elevators at Gowanus bay and Oswego and making appropriation for beginning the work.

As we have seen, the elevator idea had been of gradual growth, extending through many years, and evidently the propitious time for its consummation was now at hand, but doubtless a large factor in bringing the matter to a successful issue at this time may be found in the fact that the men who were then Governor and Superintendent of Public Works were from New York city, where the need of elevators was felt most keenly, and the further fact that both had been actively engaged in the transportation business, the Superintendent having had a lifelong experience in water carriage, chiefly on the State canals.

We can understand best the needs which wrought this favorable legislation by learning what the three State officials said in their appeals. In 1880, said one of them, the New York canals carried more than thirty million bushels of wheat from Buffalo and ten thousand or more boats were engaged in doing this. In 1919 only half a million bushels were transported by canal and less than four hundred barges were employed. This was not because grain no longer came to Buffalo; far from it. Upwards of a hundred million bushels or more of wheat were received there every year

and at the close of navigation it happened that twenty times as much grain was found lying in Buffalo harbor awaiting shipment as the canal had carried during its whole season. The State had made liberal and splendid provision at its terminals for handling most other commodities, but no facilities for the grain traffic had been furnished, and this traffic normally should constitute fifty or sixty per cent of all east-bound tonnage. In the restoration of the grain traffic to the canal lay the chief hope of interesting capital to invest in transportation lines and thus to bring about any large development of commerce on the new waterway. Carriers must have reasonable assurance of obtaining east-bound cargoes at all times and only canal elevator facilities for the predominant east-bound commodity, grain, could give that assurance. Lacking the inducement to build up a strong transportation scheme, little hope existed that the new canal would justify its cost or would function in the interest of the great majority.

Grain is a product admirably suited to carriage by water and the supply available for the Barge canal was unlimited so far as the capacity of the canal was concerned. Moreover, other carrying agencies were overburdened and were greatly in need of just such relief as the canal could give. The grain-producing area naturally tributary to the Barge canal through the Great Lakes was enormous. The vast grain belt lying around and to the west of the Lakes covered a million and a quarter square miles and produced annually five billion bushels of grain. For the welfare of the world as well as for the benefit of the producers it was highly important that the cost of shipping this grain should be as low as possible. Advocates of the Barge canal affirmed that no other route, rail or water, could compete with the New York waterway in this traffic if proper equipment were supplied. It was to be noted also that the thirty million people who lived in the territory producing this grain would require for return cargoes the products of the world and thus they would make New York city their port of export and import. In this way the boats needful for commodities other than grain and also for west-bound trade would be secured.

The conditions under which it was then necessary to handle any grain reaching New York by water were intolerable. For many years there had been passing through that harbor half the foreign and domestic commerce of the whole United States and yet there existed but five or six grain elevators and only two were situated so that canal boats could reach them. Both of these were owned by railroads and there was not even a shadow of a chance

that canal boats would be allowed to use them. As a result of this state of affairs barges laden with grain were obliged to await the arrival of the ships to which their cargoes were to be transferred. This might be one week or two or three or sometimes even longer. During this delay demurrage charges were mounting, the earning power of the barge was being lost and the cost of shipping grain by canal was rising so high as to be prohibitive. The number of boats on the canal was notoriously inadequate for the tonnage the waterway should handle, but no matter how many barges might be in service or how much grain should be available for shipment the continuation of such conditions in New York harbor could result only in wholly wiping out the canal grain business and with it would go the very foundations of canal traffic. Moreover, the useless tying up of boats which might otherwise be helping to build up canal trade was a plight so ruinous that the State for its own good should seek a remedy with the utmost speed.

Aside from the export grain traffic there was another feature to be considered. Considerable quantities of Argentine flaxseed were being imported through New York; also some corn. The future might see a reversal of past and existing practices, for it was quite within the possible that America with its rapidly increasing population might cease to export cereals and be forced to look to South America and central Europe for its supply. In such an event the existence of elevators at New York, to attract this commerce for canal movement, would be an invaluable asset.

An elevator was needed at Oswego because of Canadian activities to secure the grain-carrying trade. Excellent elevators had been installed at Montreal and in 1918 that port had handled approximately twenty-five per cent of the total wheat exports of the principal Gulf and Atlantic ports. In 1880 it had exported only seven per cent. Of the 168,000,000 bushels of Canadian wheat shipped from the head of the Lakes in 1915 over 100,000,000 bushels had gone to Buffalo and only 23,000,000 bushels to Port Colborne, the western terminus of the Welland canal. Canada was now enlarging this canal so as to accommodate lake vessels of twenty-five feet draft. It was expected that by this means considerable grain would be diverted from Buffalo, the lake boats passing into Lake Ontario and going to Kingston or on down the St. Lawrence to Prescott, the two Canadian ports. Prescott is only 119 miles from Montreal, the present head of ocean navigation. It was imperative, therefore, that New York should provide a competitive port on Lake Ontario and the logical site for that port was Oswego.

Although the distance from Oswego to New York was greater than from Kingston or Prescott to Montreal, Oswego had a more than compensating advantage to offer in the form of a return cargo, a thing that neither of the Canadian ports could furnish, at least in any adequate volume. Coal was a principal article of return cargo at Buffalo and other Lake Erie ports and the coal transshipping trestles maintained at Oswego by three railroads made possible a like traffic there. It was contended that the State would be negligent in failing to foresee the impending diversion of grain at Buffalo and in not providing at Oswego facilities which would attract that grain after it had entered Lake Ontario. Evidence of the soundness of the reasoning was found in the reported plans of a railroad company to deepen a harbor, erect a coal trestle and construct a grain elevator at a point a few miles west of Oswego. Oswego was about two hundred miles nearer New York than Buffalo. It was estimated that grain could be sent by way of Lake Ontario and the Barge canal through Oswego cheaper than by transferring at Buffalo and following the canal through its full length across the state. This was another argument for an elevator at Oswego.

At Buffalo the problem did not involve an actual lack of elevators, as at New York, but there seemed to be operating some cause which was working against the canal grain traffic. There were twenty-three elevators at Buffalo. Their storage capacity was 28,250,000 bushels and they were capable of putting 1,871,000 bushels into canal barges in a period of ten hours. But despite all this splendid equipment and although Buffalo was constantly increasing in importance as a grain port, the canal traffic in grain from Buffalo was steadily decreasing year by year. Whether this inimical agency was antagonism, discriminations adverse to canal traffic or excessive charges, was not entirely clear. It was generally understood that some if not all of the elevators were dominated by railroad influence. In any case the obvious remedy was the acquisition of an elevator by the State, through either purchase or construction, and its operation exclusively in the interest of canal grain traffic. The elevators at Montreal, owned and operated by the municipality, had been a potent factor in attracting grain commerce to that port, and with the completion of the Welland canal enlargement this attraction would be still greater. Grain is somewhat peculiar in that more than any other commodity it follows the route offering the cheapest transportation. The variation of a fraction of a cent a bushel turns its movement to or from any

route. If all that debarred the grain traffic from the canal was the difference of a fraction of a cent each bushel must absorb in charges, then surely the State was justified in providing the means whereby this equalization of costs with competitive routes could be accomplished. It was believed that a State-operated elevator might perform its service at a cost to produce a differential that would attract the grain commerce and still be able to meet the interest and maintenance charges and also earn a profit which in time would repay the initial investment. It was not the intent to make the use of State elevators free, like the canal channel, but rather to make them self-sustaining.

Thus the State officials had argued the case of canal grain elevators and the response of the Legislature was an act which authorized two of the three recommended. The law of 1920 ordered the erection of an elevator at Gowanus bay at a cost not to exceed \$2,500,000 and appropriated \$550,000 to begin the work. It also provided \$225,000 to commence an elevator at Oswego, which was to cost not over \$1,000,000.

State Engineer Williams at once proceeded to prepare plans and soon contracts were awarded for constructing the foundations for both elevators. In 1921 an act (chapter 176) appropriated \$1,950,000 for the Gowanus bay structure, completing the sum fixed in the authorizing law, but no additional funds were provided for Oswego. A spirit of economy pervaded the state in 1921, as in fact it did the whole country, and the Oswego elevator was one of the things to fall by the wayside. The building of the Gowanus bay elevator has been advancing to an early completion, but that at Oswego must await additional moneys.

It may be said parenthetically that the appropriation in 1921 for the Gowanus bay elevator is one of the only two instances we recall of more than a million dollars being allotted to any Barge canal improvement aside from that authorized by bond issue. The State Constitution prohibits the creation of a State debt of more than a million dollars except by referendum vote, but it does not prevent an appropriation of more than a million dollars from available moneys. The great bulk of the canal improvement, however, has been paid for by the sale of bonds and only occasionally has anything more or less directly connected with the canal been financed by special appropriation. The other instance of more than a million dollars being voted by the Legislature for the Barge canal occurred in 1915, when \$3,654,000 was appropriated to complete contracts previously awarded, but this sum was subse-



Elevator and terminal at Gowanus bay, New York city, the point where ocean shipping and canal barges meet. At the right is the elevator with its full equipment of modern appliances and its capacity of 2,000,000 bushels. Beside it the smaller craft may lie. Extending out on the 1,200-foot pier is a conveyor gallery for carrying grain to deep-sea vessels, there being 35 feet of water beside the pier. At the left beneath the gallery is seen the shore end of the pier shed, 1,186 feet long by 106 feet wide, with its head-house, 106 by 20 feet in size. A frame warehouse appears in the center. Terminal equipment is complete for all general traffic.

quently refunded to the State treasury, being taken out of the bond issue approved by the people later in the same year. Indirectly connected with Barge canal construction there has been one other appropriation of more than a million dollars. For acquiring the right of way necessary for improving the Harlem river the Legislature of 1922 appropriated \$1,500,000.

The capacity of the elevator at Gowanus bay is substantially 2,000,000 bushels. If the grain traffic on the canal should grow to the volume which experts say is its rightful share, then doubtless greater elevator capacity will be required, but for the present the needs are supplied. Modern practice in elevator construction, however, allows for expansion within reasonable limits by building storage bins in such form that additional units may be added at any time. The storage capacity at Gowanus is provided by 54 circular reinforced concrete bins, each 20 feet in diameter and 95 feet high, together with interstitial bins, and whenever occasion demands as many extra bins may be added as are needed. A modern grain elevator is the result of many years of experience and involves numberless details. The one at Gowanus bay has the usual equipments for conveying, weighing, cleaning and drying. There are marine towers for unloading and a conveyor system extending out upon the 1,200-foot pier for loading ocean steamers. Upon a new shorter pier it is planned to install unloaders, possibly of the pneumatic type, for handling flaxseed or other imported grain.

At Oswego, when construction is undertaken, there will probably be erected 21 bins and their storage capacity will be about 775,000 bushels. Apparatus for unloading lake boats, for loading into canal boats and cars, and for conveying, cleaning, drying and weighing will also be provided.

In our early discussion of the terminal question we saw that in the shipment of general merchandise over the length of the Great Lakes, virtually a thousand miles, the actual carriage would be about one-third and the terminal charge two-thirds of the cost; also that efficient equipment for handling ore, coal and grain had halved the expense of transshipping these commodities. These three articles are among the largest and most important items of our national commerce and the movement of grain especially affects almost everybody in the land. It is only through much study and experimentation that successful handling devices have been perfected, but the State is reaping now the benefit of all this experience and is passing it on to the people through the erection of its grain elevators and also through the scientifically-equipped terminals for the handling of all kinds of commerce.

CHAPTER X

CANAL AND TERMINAL CONSTRUCTION

Accounts of the progress of construction work year by year and also of the new work being put under contract appear in chronological sequence in the chapter but are not listed in this outline. The other chief items are the following: First Contracts Awarded and Construction Begun—Study of Rome Level Water-Supply—Studies of Rome Routes—Advisory Engineer for Superintendent—Criticisms by Superintendent—Barge Canal Bulletin Begun, 1908—Federal Aid for Termini and Hudson Canalization Asked—Survey and Assumption of Hudson River by Government—Cayuga and Seneca Branch and Terminals Added—Leaks Occasioned by New Work—Oswego Partly Closed, 1909 and 1910—Rival Projects in 1910—Mohawk River Contracts—Tests of Models of Proposed Medina Arch—First Locks and First New Sections Used, 1910—Canal Affairs Reviewed in 1910 at Request of Governor—Statement Concerning Railroad Crossings—Government Adoption of Hudson above Troy Questioned—New Plans for Lock and Dam at Scotia—Break in Bushnell's Basin in 1911—Terminals Begun—Serious Break at Irondequoit Creek—Publicity of 1912—Flood of 1913—Beginning of Navigation Aids—Oswego Closed for Sixth Year—Lyons Routes—Court Decision on Railroad Crossings—Exhaustion of Appropriation—Attempted Legislative Investigation—State Engineer's Reply—Full Discussion of Exhaustion and Reasons for It—New Referendum for Funds—Referendum Explained—Eastern Section of Erie Opened with Ceremony, 1915—Extended Review of Railroad Crossing Problem—Other Sections Opened, 1916—Lake Navigation Aids Studied—Possible Deficiency of Cayuga and Seneca Fund Reported—Rochester Work Begun—Its General Plan—Former Land Acquisitions Delaying N. Y. City Terminals—Canal Open, Ocean to Lake Ontario, 1917—First Warehouse and Machinery Contracts Let—Intense Activity in 1917—Tonawanda Situation—Rome Centennial Celebration—Cayuga and Seneca Fund Increased—Whole Canal Open, 1918—More Terminal Funds Needed—Pier 6 Opened with Ceremony, 1919—Terminal Fund Increased and Elevators Added—New System of Buoy Patrol—Statements of Terminal Work Accomplished—Elevators Begun—Governor Miller's Interest in Canal.

IN OUR study of the Barge canal we have not as yet said much about the actual work of construction, but rather have been considering chiefly questions of policy and matters of procedure. Reverting now to the beginning of the year 1905 we recall that, because certain contractors, upon request, had submitted both lump sum and itemized proposals on the first contracts

and the legality of this action was in question, Superintendent of Public Works Boyd had refrained from awarding these contracts and had left the disposal of the whole subject to his successor. Early in January the new Superintendent, N. V. V. Franchot, asked Attorney-General Mayer to render an opinion on the question. This opinion held that the Barge canal law rather than the general canal law governed the methods of asking for proposals and awarding contracts and that the Barge canal statute invested the Superintendent with large discretion, and as the contractors had acted in conformity with the request in his advertisement for proposals the bidding was lawful; also that it was the duty of the Superintendent alone to determine which was the lowest bid and to act in accordance with his best judgment for the interests of the State. Of the six contracts for which tenders were asked at the first opening lump sum proposals were received on only three and in each case itemized bids were also received which on their face were lower than the lump sum bids. The Superintendent, therefore, awarded the six contracts, each to the contractor whose bid was lowest on that particular contract. The experiment of asking for lump sum proposals ended with this first letting. Thereafter throughout the whole course of construction itemized bids have prevailed to the exclusion of any other method.

By April and early May, 1905, all of these six contracts had been signed and soon afterward the work of construction was begun. The first actual contract work was performed at Fort Miller, on the Champlain canal, on April 24, 1905; the first work on the Erie canal was done at Waterford on June 7, 1905. During the early months of these first contracts there was no remarkable showing in the amount of construction work accomplished. The contracts were all large, some of them quite large, and time was needed to assemble the necessary plants, most of the dredges, scows, excavating apparatus and other large machines having to be built on the sites of the work.

While it seemed at the time that good progress was being made during the early years of construction, in the light of later accomplishment such progress appears very slow. But this was only what naturally might be expected. In large undertakings of this character, for which carefully-wrought plans and extended preparations have to be made, it usually takes several years to get the work well under way. For a while after that it goes with a rush and later, as the end approaches and less and less remains to be

done, there is a gradual slowing down. Precisely the same law seems to hold as applies to moving bodies. At first force is required to overcome the inertia and then the momentum carries the body until another force stops it, and the larger the body the greater the force needed to start it and also the greater the momentum that keeps it going.

In the first two years of work, 1905 and 1906, the apparent result was very small, less than a million dollars being paid for construction. The next two years showed a large increase and the two after that an increase still larger by many times. But these were all years of planning on the part of the State and of preparation as well as accomplishment on the part of the contractors. Indeed the State Engineer was severely criticised for not completing all plans for all parts of the enterprise before any construction whatsoever was begun. But probably he would have been more severely criticised for doing other than he did.

After these six years there came four peak years in construction. During these four years more than fifty million dollars worth of work was done, but besides the momentum acquired from previous years there were two new additions to the project — the Cayuga and Seneca canal and the terminals — to augment the total of accomplishment for the period. No year since these four has witnessed so large an amount of work done, but as long as there remained structures or canal to build each year's record was large and the aggregate has been very large.

In the present account of constructing canal and terminals it cannot be hoped to go into details very minutely. Nor indeed does such a course seem necessary. These details are available, however, for him who must have them. Enough of the records have been published in State documents to furnish all the information the ordinary investigator desires. The annual reports of both the State Engineer and the Superintendent of Public Works have told year by year what progress was being made and what portions of the canal had been built. The account in the State Engineer's report has taken up each contract quite at length and told in detail just what had been done and what it had cost. The *Barge Canal Bulletin* was issued monthly during most of the period of construction and its record went into still more circumstantial detail. It published month by month the progress made in preparing plans, also the facts in regard to approval of plans, advertising for bids, the itemized bids received and the award of contracts, and then it described the work done each month on each

contract till all was finished or the contract was terminated for some cause. The *Bulletin* account included also a record of the money value of all work planned, contracted for and done. The Comptroller told in an annual report of the money being spent on the project. The two boards which have had to do with the Barge canal—the Canal Board and the Advisory Board of Consulting Engineers—each published the minutes of its several meetings and at the end of each year these were bound in an annual volume. Also other State officials have had a part in Barge canal construction and their reports add to the sum of available information. Other records, even to the most minute detail, preserved mainly in the archives of the State Engineer's office, may upon occasion be consulted by those who must carry their search beyond these published accounts. With all of this wealth of information so easily accessible it seems best to devote the text of the present volume to a consideration of subjects of a somewhat general import and to limit the details of specific work performed to an appended table of contracts.

The most important events in canal history for the first three or four years of the period of construction have already been discussed in the chapter on early policies and methods. The actual work of building the canal was proceeding, not so rapidly as in subsequent years, but still proceeding, and while there were as many perplexing problems of construction for the engineers to solve as is the usual lot in large undertakings, they were not of sufficient moment to leave any very lasting impress on the records.

Perhaps the most important of the things not already mentioned was a thorough investigation of the water-supply available for the Rome summit level of the new canal. This study was made in 1905 under State Engineer Van Alstyne by William B. Landreth, Resident Engineer, and it was reviewed by Emil Kuichling, the consulting engineer who had been employed to make the water-supply investigations during the preliminary survey of 1900. This study had a most important bearing on some of the plans which were about to be made, but it need not now concern us except to call our attention to the fact that such studies, of a purely technical character, were constantly being carried on in the work of designing the numberless structures and portions of channel throughout all the years of canal construction. In the days of the original canal, engineering was a new and not a very precise science and rule-of-thumb methods largely prevailed. The early engineers used good judgment, however, and were spared grievous failures. But

now engineering has so advanced that calculations are made for sizes, weight and strength down to the last minute detail and whatever may influence the stability as well as the usefulness of a completed structure is carefully considered in making the design. Engineering has become also a profession of many precedents and for successful designing there is needed a broad knowledge of what others have done in a like situation, or an originality which is so keen in foresight as not to make fatal mistakes.

In 1906 several important pieces of work were put under contract. Among them were the first of the movable dams of bridge type on the Mohawk river and the locks beside them, also the northern half of the Champlain canal, embracing the portion between the Hudson river channel at Fort Edward and Lake Champlain at Whitehall, the remainder of the land line section between the Hudson and Mohawk rivers at the eastern end of the Erie canal, a stretch near the western end of the Erie and another in the vicinity of Little Falls, and the portion of the Oswego canal extending through Fulton.

The record of contracts awarded in 1907 is not very large, although one having a length of nearly forty-four miles was included. This embraced the line in Oneida and Seneca rivers west from Oneida lake and extending to Mosquito Point. Besides this long stretch of channel there was a short section at the north end of the Oswego canal, which included the novel siphon lock at Oswego, and the fifteen miles at the lower end of Mohawk river canalization, containing the massive dams at Crescent and Vischer Ferry.

The beginning of the year 1907 marked the coming of a new incumbent, Frederick Skene, to the office of State Engineer. There have been several such occasions in the history of the Barge canal and it will be noticed that whenever a break of this character has occurred in the continuity of the engineering organization it has been reflected in various ways, generally in a temporary slowing down in the work of preparing plans or carrying on construction. Whenever in Barge canal construction there has been a change of men in the State Engineer's office it has happened that it has been a change also in the political complexion of the incumbent.

Among the studies which occupied the engineers in 1907 there appear several of considerable importance. One had to do with the canal alignment at Rome. Plans had been well advanced on what was called the north route, which would carry the channel through the city, making necessary some objectionable bridge approaches and interfering with business interests to quite an extent. The

citizens of Rome objected and plans were halted till a decision could be reached. Meanwhile investigations for a better line were being made. The solution of this problem was not easy. If the route were thrown farther south, then there were involved on the one hand some very costly railroad crossings or on the other hand an entire change of railroad location for a long distance, this change including a new station for the city and being also very costly. Several years were spent on this problem before it was finally solved.

It is interesting to notice how the canal alignment has shifted back and forth in Rome and how at each change there has been difficulty in pleasing the inhabitants. Rome shared in the first artificial waterway improvement in the state. The Western Inland Lock Navigation Company, chartered in 1792, built as one of its undertakings a canal along the portage between the Mohawk river and Wood creek. This channel was near to the line just mentioned, that called the north route. When the State constructed the original Erie canal the location was changed to the south, much to the displeasure of the citizens. During the first enlargement of the Erie, that of deepening to seven feet, the canal came back north to the first location and again there was dissatisfaction. When it was proposed to build the Barge canal along the northern route the people wanted the line changed again. To anticipate the final decision it may be said that the new waterway has now been built much farther south than even the original Erie canal.

Among the other studies of this year was one on the Rochester-Lockport level, of which mention was made in a former chapter; also one to determine a type of dam and an arrangement of spillways to lessen rather than to aggravate flood conditions in the Genesee river at Rochester, and another to find a kind of dam for the Oswego river at Phoenix which would prevent flood damages in Onondaga lake and at Syracuse. There was a study too of the harbor problem at Syracuse and this proved a question about which there were such divergent ideas that several years passed before a final decision was reached.

In 1907 the Superintendent of Public Works in his annual report complained that the new construction was making it very difficult to keep the canals open during the navigation season. This was especially true with regard to the Oswego canal and in his report a year later he recommended that the Legislature make provision for closing this branch during the season of 1909. It will appear

later how during six seasons, beginning with 1909, portions of this canal were closed.

In 1907 the Superintendent was permitted by legislative authority to appoint an advisory engineer in his department. While the Barge canal law provided for all engineering work to be done by the State Engineer, it laid certain duties on the Superintendent which in the judgment of Mr. Stevens, the incumbent at that time, required the assistance of one competent to advise concerning engineering matters. The engineer appointed was Joseph Ripley, a man who had had charge under the Federal government of construction on the Sault Ste. Marie canal and who had but recently held very important positions on the Panama canal, having been a member of the board of consulting engineers, having had charge of designing the locks, dams and regulating works, and having been assistant chief engineer. It will be seen that later Mr. Ripley held other important positions connected with the Barge canal.

A rather interesting discussion is found in the 1907 annual report of Superintendent Stevens. It is a criticism of the way the work of construction had been carried on by the State Engineer. The Superintendent based his contention on an interpretation of section six of the Barge canal law, holding that this section directed the State Engineer to make plans for the whole project before any contract whatever should be awarded. He argued that a policy after this order not only would carry out the intent of the law but also would have been of the make-haste-slowly variety, which would accomplish more in the end, and moreover that it would have been in better accord with good business principles. He complained of the slow progress being made and intimated that it was due to the adoption of this wrong policy. From this argument he passed easily to a reopening of the main issue in the whole State canal problem—whether a ship canal would not be preferable to a barge canal—and before he finished he recommended that the Legislature should memorialize Congress to join with New York in making that portion of the Barge canal which extends from the Hudson river to Lake Ontario, by way of the Mohawk river, Oneida lake and the Oswego river, a ship canal of the type contemplated in the report of the Deep Waterways Board of Engineers in 1900 and also that such pressure should be brought to bear on Congress as to accomplish the suggested plan.

It is somewhat difficult to follow the logic of Mr. Stevens' argument. Knowing how great an amount of designing work the engi-

neers have found necessary throughout the larger part of the construction period, it does not readily appear that the time required for building the canal would have been shortened materially by delaying construction till all plans were ready. His thought evidently was that the purpose of the law as he interpreted it was to guard against building the canal in such manner as to overrun the appropriation. We have seen already that the State Engineer, because of charges during the canal campaign that the estimates were unreliable, had perceived the necessity of ascertaining as accurately as possible the whole probable cost. By his selection of a wide variety of work for the first contracts, thus making them in effect test contracts, he had demonstrated with what appeared to be reasonable certainty that the entire canal could be finished within the appropriation. In a former chapter it was seen also with what care and thoroughness the State Engineer had proceeded during the first years of planning. His policy indeed had virtually been to make haste slowly. It may be said in passing that Mr. Stevens' interpretation of the law was deemed untenable by legal authority. The Superintendent's suggestion that the whole work should have been put into ten contracts and that this arrangement would have resulted in less contract machinery and at the same time would have hastened contract work seems rather absurd.

The whole argument shows a lack of an appreciative understanding of the engineering features of the project, but on the other hand it must be remembered that Mr. Stevens was a remarkably astute and successful business man. It cannot be denied, however, that in the attitude of Mr. Stevens and also in that of others who have held the office of Superintendent during Barge canal construction there may be seen a querulousness which seems to arise from resentment at the inactive position in which they found themselves under the Barge canal law, in evident forgetfulness that it was due to the evils of dual responsibility under the nine-million project that they had thus been shorn of power.

Mr. Stevens' advocacy of the ship canal plan illustrates the persistence of this idea. Throughout the whole period of the Barge canal and in all parts of the state many persons have continually been met who would shrug their shoulders whenever the canal was mentioned and say that perhaps it is all right but it ought to have been made large enough for ocean-going ships to reach the Great Lakes and moreover the Federal government should have built it.

A year later Mr. Stevens again deprecated the lack of progress and suggested that the power given under the Barge canal act

should be invoked and the work be taken from certain contractors and put into the hands of the Superintendent. Occasionally in the course of constructing the canal this drastic remedy has been resorted to, but such measures have been reserved for extreme cases of failure on the part of the contractor and then not until no other way seemed open.

In the years 1907 and 1908 we find the beginnings of several important canal affairs. Both the State Engineer and the Superintendent of Public Works were recommending canal terminals, but these suggestions were limited to New York and Buffalo and the terminal idea of broad scope did not appear until later.

In January, 1908, State Engineer Skene adopted a policy that was rather wide-reaching in its influence and which was continued by all of his successors. This was the issuing of a monthly publication, the *Barge Canal Bulletin*, which ran from February, 1908, to January, 1919. Since this publication is discussed at some length in the chapter on advertising the canal, it need not at present have more than this brief mention.

Mr. Skene also took a firm stand for the canalization of the Hudson river by the United States government. He joined forces with those who were advocating a 22-foot channel between the Barge canal and the ocean, this having been the time when the business organizations along the river formed the Hudson River Improvement Association in order to advance the interests of that project.

Mr. Skene continued the attempt of his predecessor to induce the Federal authorities to assume responsibility for canalizing the Hudson north of Troy. He even went to the length of printing in attractive form the report of the study made under Mr. Van Alstyne on this subject and presenting it to Congress in the form of a memorial. This study we have already reviewed. He also urged the Legislature to request the National government to improve both Lake Champlain at the northern terminus of the Champlain canal at Whitehall and the Oswego river at the northern terminus of the Oswego canal at Oswego. It happens that Federal waters adjoin the four main termini of the Barge canal system, these lying at Waterford, Whitehall, Oswego and Tonawanda. If improvements were not made at these four points by the time the new canal should be completed, then boats of enlarged size would be confined to the canal itself and the value of the deepened channel would virtually be nullified as long as outlets of like dimensions were withheld. It can be seen then that the time was none too soon to

begin agitation for this Federal coöperation. The Niagara at Tonawanda was already being improved under the United States engineers, but as we shall see, the other projects dragged along for years and finally the State had to step in and open a channel at one terminus in spite of the fact that it was working in Federal waters and was doing what in fairness the Federal government should have undertaken.

Although with 1909 there came another change in the office of State Engineer, Frank M. Williams entering upon the duties, in the matter of the channel between Troy and Waterford the new incumbent continued along the same line as his predecessors. But the time was growing short and so we find him urging upon the Legislature all speed lest the Champlain branch be completed before the southern outlet should be ready. Early in 1909 Superintendent of Public Works Stevens had been instrumental in securing a Federal appropriation for a survey of the Hudson, which was to determine whether the United States should assume this enterprise. It appeared probable that the engineers would report favorably and also Government officials seemed disposed to grant the desired aid, the chairman of the House Rivers and Harbors Committee having assured representatives from the state that he would do all he could to induce the United States to undertake the work and complete it in time for Barge canal traffic, but the prospect for immediate action was doubtful and so Mr. Williams was urging haste. And this effort was not in vain. The Congress in session in 1909-10 made an appropriation for the work and on July 1, 1910, as soon as the funds became available, the army engineers, under the direction of Col. William M. Black, began work on the plans for a lock and dam at Troy. Credit for securing this aid from the Government belongs to several people and also to a number of organizations. Chief among them are the State officials and the chambers of commerce of Albany and Troy.

Among the pieces of work put under contract in 1908 were some that covered stretches of canal extending for twenty-two miles between Eagle Harbor and Lockport and for sixteen miles between South Greece and the Monroe-Orleans county line; also a section of canal at Little Falls, including the lock of highest lift ever undertaken up to that time, and another section at Baldwinsville, together with the dam in the Oneida river at Caughdenoy. In addition contracts were awarded for building three more locks and movable dams of bridge type in the Mohawk and for constructing the great reservoir on the headwaters of the Mohawk at Delta.

For several reasons the year 1909 is memorable in Barge canal history. The obtaining of Federal assistance in the Hudson is one reason. In this year also the Cayuga and Seneca branch was added to the enlarged system. A renewed and an aggressive agitation for this project began with the year and by means of a quick and intensive campaign legislative approval was secured during the current session and also popular authorization was achieved before the year had closed. But the outstanding reason for remembering 1909 is the terminal investigation begun in this year. Almost on a parity with the canal question itself stands that of adequate terminals, and the time of its inception, therefore, becomes a mile-stone in canal progress. But it is not necessary now to do more than mention either the new branch or the added terminals; each has already had its special chapter. Of the Hudson river scheme we shall hear again.

Because of interference arising from new construction the Superintendent of Public Works was having trouble in maintaining navigation on the canal, chiefly on the sections where the old and new alignments coincided. During the winter of 1908-09 more than forty culverts and other structures on the stretch between Rochester and Lockport were uncovered for the purpose of reconstruction or enlargement. Fearing that there would be leaks when the canal was refilled in the spring, the Superintendent set patrols, installed a temporary telephone line and at critical points stored supplies for making repairs. These precautions were wisely planned. Even before the canal was full leaks began to show at several of the structures and at a dozen or more of these the trouble proved so serious that the levels had to be emptied and the structures reinforced with a concrete covering. This experience resulted in adopting new methods for doing work of this character; also in a closer coöperation between the Superintendent and the State Engineer, the latter instructing his resident engineers not to allow a contractor to disturb any old structure which was essential to navigation until the Superintendent had been notified and had given his written permission.

It will be recalled that the Superintendent had recommended that the Oswego canal be closed while reconstruction was going on, since the maintenance of navigation on this branch was particularly difficult. In response the Legislature authorized him to close about half of it, the part between Three River Point and lock No. 10 at Fulton, during the whole season of 1909, and the remaining portion, that from Fulton to Lake Ontario, until the middle of July. By a

law of 1910 permission was given to keep the southern half closed again for all of that year or to open any part of it from time to time as the Superintendent deemed best.

Publicity was given to two rival canal projects at about this time. On June 10, 1909, a Federal board of engineers reported to Congress on a proposed 14-foot canalization of the Mississippi from St. Louis to the Gulf, a scheme known as the Lakes-to-Gulf project. This was estimated to cost \$128,000,000 for construction and \$6,000,000 annually for maintenance. The engineers reported the scheme as not desirable. A few months earlier a Canadian report was made on the Georgian Bay Ship Canal, a proposed 22-foot channel between Georgian bay, an arm of Lake Huron, and the St. Lawrence at Montreal, estimated to cost \$100,000,000.

The work put under contract in 1909 was large in amount and of much importance. It included about ninety-seven miles of channel in the eastern portion of the Erie canal. This embraced nearly all parts between the Hudson river and Oneida lake except the few stretches previously contracted for. In addition there were a section of five and a half miles near the Genesee river, another of four miles in the Hudson near Mechanicville, a small stretch at Phoenix and two locks in the Champlain canal.

In the contracts let in 1909 there were four which redounded much to the honor of State Engineer Williams. These were the contracts for canalizing the Mohawk from Rexford to Little Falls, well known among contractors at the time as the original Contract No. 20. In one form or another this work had been unsuccessfully submitted to bidders several times, beginning with October, 1907. In December, 1908, it had been offered for the last time in its entirety of nearly fifty-nine miles. The lowest bid at that time was \$4,913,168.25, which was more than ten per cent above the engineer's estimate and consequently could not be accepted without formal approval by both the Canal Board and the State Engineer, but such approval was withheld. Because of earlier failures to receive acceptable bids the specifications under the offering of December, 1908, had provided for the acceptance of the finished work in eleven sections, the contractor thus not being required to maintain the whole length in a finished state until the entire contract should be completed. The plans were revised in 1909 by dividing the work into four parts. The aggregate of the four lowest bids on these parts was \$4,690,546.90, a sum less than the 1908 bid by nearly a quarter of a million dollars. The elimination

of the objectionable feature of accepting the work in eleven sections was perhaps of still more importance, since under the modified arrangement each contract had to be maintained in a completed state until it was accepted — a marked advantage for the State.

A series of tests was carried on under State Engineer Williams in 1910 which was extremely important, but since the tests were of purely technical character little public comment was elicited. These tests were important to the engineer because they were in a field previously almost devoid of authoritative information, but they had a very practical purpose, their engineering value being entirely adventitious. They were of vital importance to the State because they were made in order to determine whether it was safe to build a certain proposed structure of somewhat remarkable design. In the event of failure of such structure the people of the state surely would have been aroused to the importance of tests which might have prevented so unfortunate an occurrence. Such was the real purpose of making these tests.

The tests had to do with construction at Medina, where, if the canal should avoid an objectionable loop, it was necessary to cross a deep gorge. After careful consideration of various types of steel and concrete aqueducts and also of a high embankment, it was decided that a concrete arch of single span, carrying a reinforced concrete trunk, was to be preferred. The length of span, center to center, would be 290½ feet; the clear span, 285 feet, five feet longer than any concrete arch structure theretofore attempted and by far the longest single span arch aqueduct ever planned and one which would have to carry loads much in excess of those ever imposed on any similar long arch. The weight of water to be carried by the single span was 12,400 tons, the total load, including weight of structure, 46,000 tons. The width of the aqueduct was to be 129 feet.

By virtue of the length of span, the total width, the great load to be carried and the necessarily great cost, the proposed Medina aqueduct may properly be considered the most important piece of concrete arch construction ever planned up to that time. It was deemed both advisable and necessary, therefore, not only to develop the design with the greatest care along the lines of the most approved theory of arch construction, but also to make a series of tests on concrete prisms and arch models for the purpose of obtaining additional information concerning the behavior of concrete under certain conditions of stress. Moreover, from reputable

sources suggestions had been made that such an arch was in danger of failure through shearing on a vertical plane at or near the skew-back at a comparatively low resistance and long before the true compressive strength of concrete should be developed.

This series of tests, however, which was continued until there could be no reasonable doubt of the results, did not corroborate the theory in this suggestion, but showed conclusively that the arch would sustain its load in true arch fashion and that there was no danger of failure from so-called shear. Reports of the results of these tests were published in the *Barge Canal Bulletin* and the State Engineer's annual report and were copied by the engineering press of the country. It may be added that although these tests removed all fear that the structure as designed was defective, the aqueduct was not built. Instead the new canal follows the objectionable loop of the old canal. The reason for this was the character of the rock upon which the aqueduct must have been founded. It was a sandstone, known locally as "red horse," and doubt of its sustaining power caused the aqueduct plan to be abandoned.

In 1910 the first of the Barge canal locks was used for passing boats. This was the lock at Baldwinsville and the time of its first use was May 9. In order to be used the walls, gates and valves had to be completed, but operating machinery was still lacking. To supply the deficiency the gates were swung by means of block and tackle and horse-power, and the valves were raised by chain hoists. The lock chamber filled smoothly and its operation was entirely satisfactory. But the use of the lock at this time was not connected with regular canal traffic. The channel at Baldwinsville was so situated that it could not be used until adjoining long sections had been completed. The boats to pass the lock were parts of the contractor's construction fleet. About a month earlier the gates, valves and power culvert of the lock at Comstock, on the Champlain branch, were operated, although no boat was present to be locked through. Traffic passed through this lock during the 1910 season, but conditions were such that temporarily one level was being maintained on both sides of the structure and so it was not for the time fulfilling any of the functions of a lock. On May 28, 1910, another new lock was brought into use and this was the first one to serve really as a lock in regular canal traffic. Additional interest attached to this structure because it was the siphon lock at Oswego, the first siphon lock to be built in America and the largest lock of the siphon type ever to have been built.

With the opening of navigation in 1910 there came into use the first of such new sections of canal as were being built along new locations. This was the northern portion of the Champlain branch, from Fort Ann to the Lake Champlain terminus at Whitehall. Work along this stretch had not been entirely completed, but it was so far advanced that the old canal between these limits could be abandoned and traffic could be turned into the new channel.

In 1910 the first of the Cayuga and Seneca contracts were awarded. These provided for dredging about seventeen miles of channel and for building the lock and dam at Cayuga. The number of contracts let during this year on the other canals was large, totalling more than a score, and the work covered by them included very nearly all parts of all three branches not already under contract. Almost all of the eastern half of the Erie canal was previously under construction and a section between Rome and Oneida lake added in 1910 virtually completed the contracts for building that portion. The work under eight of the contracts let this year lay in the western half of the Erie and after awarding these not many miles of the whole Erie branch were still unprovided for. Much of the remaining portions of both the Champlain and Oswego canals was also included in the contracts of the year. In addition the first two of the contracts for installing electrical operating machinery were let and also a contract for the great storage reservoir at Hinckley and another for the diverting channel to carry the waters from this reservoir to the point of need on the Rome summit level.

With 1911 there came another change in the State Engineer's office. Since the break in this instance was more marked than on former occasions, it is well to consider the general status of canal work at this time. This is given succinctly in the State Engineer's annual report for 1910, which reads as follows:

"At the end of 1910 about one-third of the work of construction on the whole canal is completed. There are under contract 422.2 miles of canal (including the Cayuga and Seneca), besides contracts for various electrical installations, bridges, dams and other structures, two great storage reservoirs and a feeder of nearly six miles leading from one of them. Of the remaining work, plans for 7 miles are completed, while those for 2.3 miles are at least three-quarters finished and those for 9.1 miles of canal and for the Glens Falls feeder are well under way. Thus it is seen that about 96 per cent of the canal mileage is under contract.

"With the exception of various minor structures, operating machinery and the like, there remains to be contracted for: Two sections of less than a half-mile each, one at either end of the Erie canal, a stretch of about two miles at Medina, the spur of seven miles to Syracuse, including five miles of lake navigation, the arm of $3\frac{1}{4}$ miles in the Genesee river, together with a dam, to form a harbor for Rochester, and some five and one-half miles of the Cayuga and Seneca canal. Thus, the Champlain and Oswego canals are under contract throughout their entire length, the extent of the Erie is broken only by a gap of two miles at Medina and by half-mile stretches at each end, and the 23 miles of the Cayuga and Seneca is three-quarters contracted for.

"The value of work under contract, at contract prices, or completed, amounts to \$72,710,553, exclusive of the Cayuga and Seneca canal, and at the close of 1910, \$25,869,723 has been earned on construction work. . . .

"It was expected that 1910 would make a better showing than any of its predecessors and it did not fail in this respect. During the year construction work to the value of \$9,578,408 has been done, and 107 miles of canal have been put under contract, besides the great storage reservoir at Hinckley and a feeder 5.75 miles long, to divert its waters to the Rome summit level.

"From the figures for former years (\$330,120 in 1905, \$711,490 in 1906, \$2,216,300 in 1907, \$5,443,303 in 1908 and \$7,590,102 in 1909) a comparative view may be obtained. In the years 1909 and 1910, the period of my administration, the value of work done, \$17,168,510, is seen to be twice as large as that for the whole period of work (four years) that went before. Also, studying the mileage table of contracts let (23.9 miles in 1905; 43.6 miles in 1906; 59.5 miles in 1907; 67.1 miles in 1908, and 121.1 miles in 1909) it may be seen that the miles of canal awarded during these two years of 1909 and 1910 is 54 per cent of all that under contract to the present time, or 52 per cent of the mileage of the whole undertaking.

"When the amount of work done in 1910 is considered, it must be remembered that many of the large contracts have been let so recently that actual construction has not yet started or has but just begun. Even on the great dredging contracts on the Mohawk river, that were awarded more than a year ago, the work has scarcely begun, so extensive plant installations being required that

the machines are still in the trying out stage, before acceptance from the builders."

The period 1909-10 marked the high tide of canal work so far as planning and putting work under contract was concerned. During these two years \$39,594,432 worth of work, according to contract bids, was awarded.

Near the end of 1910 there came an inquiry into canal affairs by the Governor which demands our attention. The political situation of the day may have influenced the Governor in part in his action, for the campaign that autumn had been most stormy, but probably his own observations during a long public career had more to do with it. Governor White had but recently become the chief executive of the State. Upon the appointment of Governor Hughes to a place on the United States Supreme Court in October he had succeeded to the office of Governor. Governor White had been State Senator for many years and immediately afterward had been elected Lieutenant-Governor. As Senator he had known much about the canal and as Lieutenant-Governor he had been a member of the Canal Board. At a Chamber of Commerce dinner in New York on November 17, Governor White gave expression to his views on canal matters in a speech which attracted considerable attention. This he followed by addressing letters of common import to the State Engineer, the Superintendent of Public Works and the Advisory Board of Consulting Engineers, in which he said in part:

"After becoming Governor, this [the Barge canal project] seemed the most important subject before the State government, and since then I have been giving it careful study and investigation. The complaints and criticisms received, and the information obtained convinced me that it was a public duty to call the attention of the people of the State, not only to the progress of the work up to this time, but also to dangers and problems of the future,—not so much in a spirit of criticism as in the hope that public attention might be fixed upon this great work and the most strenuous efforts made to complete it expeditiously and in a way creditable to the State.

"I believe it is desirable that the people of the State shall have a complete and thorough knowledge of the conditions at this time, and that those in charge of the future conduct of the work may have the benefit of your information and experience.

"I, therefore, request a report from you covering, as fully as practicable, in the brief time remaining, the situation presented by

the constitutional and statutory provisions, the character of the work up to this time, and such recommendations as you may see fit to offer."

Replies were received from the two officials and from the board and in them the canal problems were discussed very freely. In reviewing these replies it is well to consider first the one from the Superintendent of Public Works, since his letter partakes largely of the nature of a criticism of the existing order, while the replies of the State Engineer and the Advisory Board contain a general defense of that order.

It will be recalled that in 1907 Superintendent Stevens criticised the State Engineer for the manner in which he had begun construction before the plans for the whole project had been completed. Mr. Stevens was now finishing a term of four years as Superintendent of Public Works. In company with the State Engineer and the members of the Advisory Board the Superintendent had spent nearly two weeks in June, 1910, in visiting the various pieces of construction work. On the 15th he had made a report to Governor Hughes, criticising some of the details of the work, and on the 25th the State Engineer had replied to these criticisms and had furnished to the Governor a detailed statement of the status of work upon the several canal contracts.

A reading of the Superintendent's reply gives one the impression that the whole official machinery charged with canal construction was fundamentally wrong and that as a result very slow progress was being made. The criticisms covered nearly the whole field of activities, but they were not constructive, the only definite suggestion for a change being one which was considered by many to possess very grave faults and which also would have occasioned much delay in carrying out. The Superintendent seems to have ignored the chief cause which had brought about the existing order of conducting canal work, namely, the failure of the method governing the 1895 enlargement.

There was much foundation in fact, however, for some of the criticism and people in general recognized this, but remedies which would not bring other troubles of as serious a nature did not seem to be at hand. The Superintendent decried the lack of continuity in responsible control, calling attention to the fact that a change had occurred every two years in the office of State Engineer. This complaint was only too true; there had been up to this time as frequent a swapping of horses in crossing the stream of canal construction as could naturally have happened. The Super-

intendent charged also that the State Engineer had too many other duties thrust upon him, that the salary was inadequate to the grade of service demanded and that he was detrimentally handicapped by not being allowed under civil service rules to secure such assistance as would be for the best interests of the State. The Superintendent also reiterated at length his belief in what he termed his make-haste-slowly policy, he deprecated the necessity of maintaining navigation during new construction, he complained that contracts had been allowed to drag along without applying the remedy of cancelation and reletting, he told of his requiring from the Advisory Board certificates of construction satisfactorily done, and he suggested as his solution for the difficulties a commission of three or five members, to have supreme and directing control.

State Engineer Williams in his reply acknowledged that the official machinery was somewhat unwieldy and did not always work as expeditiously as might be desired, but he said that on the other hand it possessed the advantage of putting a check upon each act of the State Engineer, the official in chief responsible charge, by three independent persons or bodies, thus minimizing the number of mistakes likely to be made inadvertently, although sacrificing something of speed. He believed it would be of considerable advantage to the project if some scheme could be worked out whereby there could be obtained a continuity of administration and some consolidation of authority and responsibility without at the same time losing the feeling of confidence inspired by the existing plan of control. He considered it impossible to put the work in the hands of a commission without amending the State Constitution, and said that a commission containing the State Engineer and the Superintendent of Public Works with their duties as then defined would have no real authority aside from these two officials and would be subject to a biennial change in its most important members. He agreed with the Governor in thinking it desirable that the people should have a complete knowledge of the progress of construction and said that to that end his department had issued a monthly publication, the *Barge Canal Bulletin*, which had been given wide circulation and had shown each month the exact status of the work and the money spent for it. He declared that as a rule contracts were progressing satisfactorily and moreover that as yet the State had not suffered by reason of the failure of any to make rapid speed, since uncompleted adjoining contracts prevented the use of these portions of the canal. Several times the State had annulled contracts because of slow progress and in each

instance, if a new contract had been let, about a year had elapsed between the stopping and the starting of work. These experiences had taught that this method of hastening progress could not be looked upon with much favor. The State Engineer believed also that the whole work could be completed within the original appropriation, if it were pushed honestly and economically.

The reply of the Advisory Board was along somewhat the same lines as that of the State Engineer. The members said that they did not look upon the existing plan of administration as ideal but doubted if it could be improved under constitutional requirements. The really serious defect, they thought, arose from the frequent changes of the officials in control, and this condition would be almost fatal were it not for the provision in the Barge canal law for a continuing body—the board of which they were members, which during the progress of the work had changed in its personnel in but minor part and very slowly at that. In view of past lessons and future prospects they deemed it undesirable to make any change in the administrative system, adding, “The Board believes that the present system while cumbersome in some respects does and will in its final result succeed in guarding the work and having it carried to completion in a good and economical manner and within the appropriation.”

The autumn of 1910 witnessed a heated political campaign in New York state. Feeling ran high. Policies, measures and public acts were bitterly criticised and as stoutly defended. Among the matters thus attacked and upheld the Barge canal had a conspicuous place. The campaign ended in a political turnover, a sweeping change from the existing order in the executive, the administrative and the legislative branches of the State government. That work on the canal should reflect this upheaval was but natural.

When State Engineer Bensel entered upon his duties he found several things not to his liking. Among them was the slow progress being made by some of the contractors. In February he published a table showing the status of contracts. The text accompanying the table tells the story and we quote it:

“The accompanying table, now for the first time published in the *Bulletin*, sets forth more clearly than a lengthy description can tell it, the exact condition of contract work at the beginning of 1911.

“Analyzing this table, it may be said that the work covered by 9 contracts has been finished, 4 contracts have been terminated for one reason or another and 10 contracts were let so recently that the

requirement for beginning operations was not in force at the beginning of the year. Of the 58 remaining contracts, 5 are for structural steel work and are somewhat dependent on the completion of structures under other contracts for opportunity of progressing; 6 are ahead of the percentage that should be done; some 5 are very nearly equal to this percentage, and 3 or 4 others are not far behind.

"This leaves 38 contracts, or nearly half of the 81 let thus far, that are noticeably backward in progress. For some of the large contracts, awarded more recently and requiring extensive plant installations, there may be opportunity to increase speed and finish on time. But trouble may be looked for on the contracts that are much behind the schedule."

Another feature the new State Engineer objected to was the manner in which negotiations had been made with railroads for changing such of their bridges as crossed the new canal. We quote what he said in his annual report of 1911 concerning this matter and at the same time call attention to what was said about the same subject in the statement the State Engineer issued early in 1915, when he was speaking in regard to the condition of the Barge canal appropriation.

"At several locations along the line of the new Barge canal," said State Engineer Bensel, "the work of construction had been hampered and in some cases stopped by the fact that no negotiations had been consummated for the necessary rearrangement of the contracts along the railroads' right of way. Throughout the length of the Barge canal there are 86 separate crossings and in the majority of cases changes are necessary in the grade of the railroad and the requirements also necessitate new bridges being erected. Negotiations have been consummated for some of the most important of these crossings and the work where such negotiations have been completed is now under way by the railroad companies. Previous to the present year but little had been done in this regard and the nature of the work is both difficult and troublesome on account of the features which enter into the question of damage and the difficulty of maintaining the traffic while the work is in progress. During the past year six agreements have been consummated with the railroad companies and at eight other locations construction work has been started by the railroad companies and negotiations are at present pending at numerous other places and the progress of the canal work is but little hindered except at two localities which are now under way for settlement."

Another change of policy was that effected by the Canal Board of 1911 in reversing the action of its predecessor in regard to water leases at the Troy dam. This is a subject of which we shall hear later. Concerning its status in 1911 State Engineer BenseL said in his annual report:

"During the year 1910 action was taken by the previous Canal Board in an effort to cancel existing leases of the water not necessary for navigation purposes at the Troy dam. Early in the year discussion arose as to the right of the Canal Board to cancel in the manner which they did these existing leases on which depended the carrying on of certain portions of the work necessary for navigation at this locality by the United States Government. In accordance with the opinion of the Attorney-General the previous action by the Canal Board was not deemed proper and was rescinded. This brought about some discussion between the State authorities and the United States Government as to the building of the Troy dam, and while the questions at issue have not as yet been definitely decided it is hoped that in the near future the work of constructing the Troy dam may be undertaken by the State in such manner as was originally contemplated when the people voted the \$101,000,000 for the improvement of the canal system, to extend from Congress street, Troy, to Buffalo, and thus preserve for the benefit of the people the water, which will be collected by the dam and which will not be needed for purposes of navigation. I am of the opinion that the State should construct this portion of the canal system in accordance with the vote of the people and thus secure the control and operation for the benefit of the people of not only the lock, which will be the throat or entrance to all of the State canal system, but also the water which will be available for power."

During 1911 a new design was made for the lock and dam at Scotia. Work had been started at this site in the latter part of 1908, but the contractors were not successful in unwatering the coffer-dam they had built, although attempts to do this had been made at various times until May, 1910. In August of that year the contractors had made application to be released from building these structures and had asked for reimbursement for alleged damages. The State had held that conditions here had not thus far proved more difficult than those successfully met in constructing dams on similar natural foundations in other rivers and that there was therefore no cause for annulling the contract or altering the plans. The new administration took a different view of the

case and drew plans for building the foundations within pneumatic caissons.

Another problem to confront the engineers in 1911 was the method of strengthening the bridge superstructures at the movable dams in the Mohawk river. These bridges carry the movable parts of the dams and also the operating mechanism. Some little time before this it had become evident that the superstructures were too light, and the question now arose whether they should be strengthened simply so that they could operate as dams, as originally intended, or so that they might serve as highway bridges in addition.

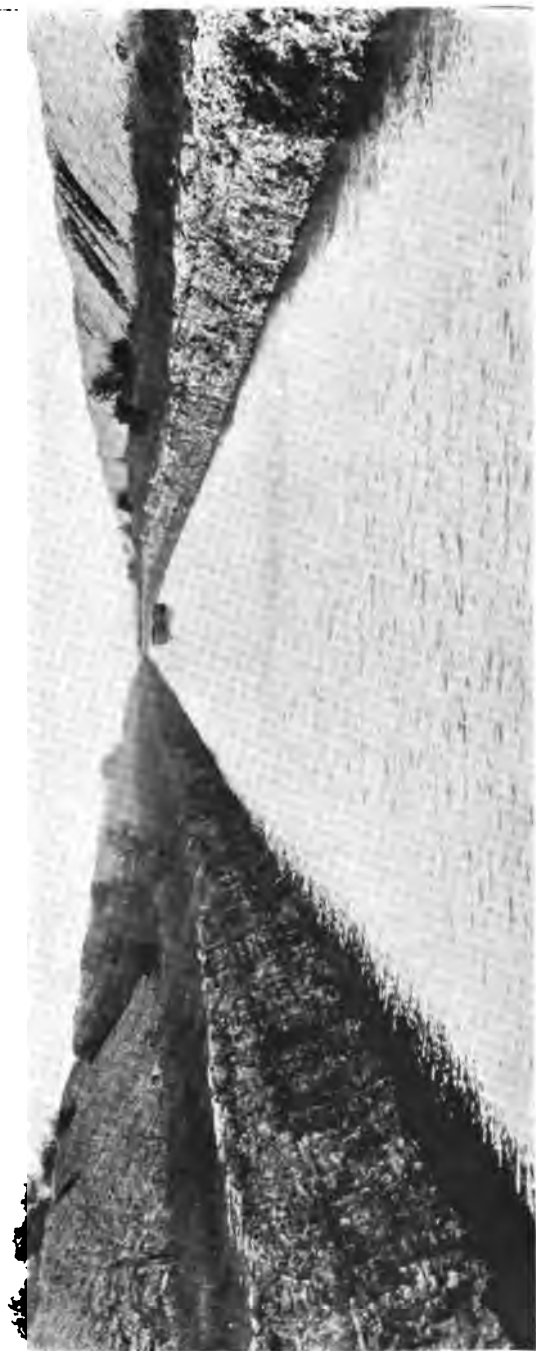
An act of 1911 allowed parts of the Oswego canal again to be closed — that between Three River Point and lock No. 11 at Fulton until July 31 and that between Three River Point and Lake Ontario from September 15 to the end of the season.

A break early in 1911 in the canal at Bushnell's Basin, near Rochester, where the channel is carried on a high embankment, called attention to the need of some means for guarding against similar accidents in this vicinity. The contract plans were altered so as to provide for conducting the canal over the embankment in a concrete trough.

In March, 1911, the first of the winches for operating the movable dams on the Mohawk river were delivered. These came to the Fort Plain dam and after certain preliminary work the gates were lowered into place against the concrete sill in the river bottom and the structure began to function as a dam.

So much of the whole canal line was under contract at the beginning of 1911 that we find but few new contracts let during the year and even these were of a minor character. The list contains three contracts for bridges, one for a guard-gate, two for transferring bodies from flooded areas to new cemetery sites and one for completing work in Fulton, which a former contractor had failed to do, thereby forfeiting his contract. But the year 1911 saw much work done on the contracts already in force, the increase being sixty per cent over that of the previous year and the total amount being equal to three-fifths of all that had been accomplished during the six preceding years, the period of construction. The contracts found backward at the beginning of the year had advanced, so that at the close they averaged about 86 per cent of completion.

The outstanding event of 1912 was the beginning of work on the canal terminals. As soon as the official canvass of the vote on the referendum was made in December, 1911, State Engineer Bensel



Channel in rock cut, near Rochester. The length of this rock cut is five miles. It reaches a maximum depth of 40 feet. The channel has a bottom width of 94 feet. In some places the sides were cut by channeling machines.





had appointed an engineer to take charge of the new undertaking and had begun to assemble for it an engineering organization which was distinct in large part from that engaged on the main project. While the terminal law described rather definitely the locations of most of the terminals, the exact locations were left for determination by the State Engineer and the Superintendent of Public Works, subject to the approval of the Canal Board. To gain the benefit of the opinions and desires of the people chiefly interested the State Engineer conducted several public hearings. That rapid progress was made in planning terminals is evidenced by the record, which is shown in the following quotation from the State Engineer's annual report. It should be explained that the fiscal year ended with September.

"To the end of the present fiscal year location plans for Barge canal terminals for the following localities have been approved by the Canal Board: Ithaca, Albany, Little Falls, Utica, Gowanus Bay (South Brooklyn), Schuylerville, Schenectady, Rome, Lockport, Mechanicville, Fonda, Fort Edward, Greenpoint (North Brooklyn), Amsterdam, Erie Basin (Buffalo), Herkimer, Ilion, Troy, Constantia, Syracuse, Cleveland, Watkins, Port of Call (New York city) and Dresden.

"Contracts have been entered into providing for the construction of terminals at the following localities: Ithaca, Albany, Little Falls, Mechanicville, Fort Edward, Schenectady and Herkimer.

"Plans have been completed for the terminals at Gowanus Bay, Whitehall, Fonda, Ilion, Amsterdam, Rome, Lockport and Utica, and partly completed for Troy and Syracuse."

On the morning of September 3, 1912, there occurred a serious break in the canal at Irondequoit creek. At this point the new canal coincided with the old and ran on top of a high embankment, widened for the purpose, the new channel being carried in a concrete trough, which had been built the year before. The break was occasioned apparently by the giving way of the culvert which carried Irondequoit creek under the embankment. This caused the trough to break and the escaping canal waters washed out about five hundred feet of embankment. So great was the length of the damaged portion that some persons familiar with repair work predicted that navigation could not be resumed during the season. But officials from the State Engineer's and Public Works departments were on the ground within a few hours and before the day had passed plans had been formulated and the organization of forces and the shipment of equipment and materials had begun,

and within five weeks a new temporary channel was ready. In making repairs a concrete dam with an opening for the passage of boats was built at the end of each unimpaired section of canal and after the necessary filling had been made a wooden trough was constructed between these dams. The trough was 887 feet long, 22 feet wide inside and carried a seven-foot depth of water. It was supported by piles 25 to 35 feet long and driven to refusal in the embankment.

The State Engineer's report for 1912 contained a recommendation for the Legislature to take such action as was necessary to secure again for the State the work of constructing the lock and dam at Troy, in order that the State at the same time might regain jurisdiction over the dam and the potential water-power there available. Another recommendation urged on the Legislature the necessity of securing Federal coöperation without delay in the matter of improving the outlets at the several canal termini. The report also mentions the problem of railroad crossings and states that questions concerning financial responsibility at these crossings were being taken to the courts.

The publicity accorded the Barge canal in 1912 calls for brief attention here, although the details of some of the events are given elsewhere in the volume. Canal exhibits were shown at six expositions, one each at Philadelphia and Pittsburg, Pa., New London, Conn., and Syracuse, and two at New York city, and at the three out-of-state places lectures were delivered. Papers were read at two waterways conventions—that of the State association at Watertown and that of the National organization at Washington. Many lectures were given throughout the state, and two excursion parties, composed of eminent foreigners and each traveling by special train, made inspection trips over the length of the canal, accompanied by representatives of the State Engineer's department.

A fairly large number of canal contracts was awarded in 1912. Fourteen bridges were included, two of which were long structures of concrete arch type, across the Oswego river, the State in each case building the span over the canal and the town building the remaining portions. Five contracts were let for completing work where former contractors had failed and these embraced the southerly part of the Champlain canal, the redesigned lock and dam at Scotia, part of the stretch in Fulton and a section in the Seneca river near Mosquito Point. Work on the Cayuga and Seneca branch included the locks and dams at Seneca Falls and Waterloo and the spurs at the heads of both Cayuga and Seneca lakes, that

at Watkins having been authorized by amendment to the original law. Then there were contracts for the Glens Falls feeder and the Onondaga lake outlet; one for electrical installation, another for a building at the Delta reservoir, and one or two more for minor details, such as clearing areas to be flooded and removing bodies to new cemeteries.

The closing of the Oswego canal authorized in 1912 included the portion between lock No. 11 at Fulton and Lake Ontario and extended from the beginning of the season to July 10.

In March, 1913, there occurred a flood of unprecedented proportions, which severely tested Barge canal construction. The high water was due to very unusual rains rather than to melting snow, and a wide area was affected, the flood that wrought such havoc at Dayton, Ohio, being caused by the same storm. The whole of the old Champlain canal and the eastern portion of the Erie, as far west as Little Falls, were completely under water. Embankments both old and new were washed away in several places, especially on the Champlain branch, but the new concrete structures escaped with almost no damage, in spite of the fact that they were forced to withstand strains which had never been anticipated. The Legislature, then in session, appropriated \$75,000 for immediate repairs and these were made in time for the opening of navigation. A second appropriation, amounting to \$200,000, was made for repairing damages to the Barge canal and this work was done later by contract.

The terminal contracts awarded in 1913 included those for Whitehall, Fonda, Ilion, Frankfort, Amsterdam, Fort Plain, Utica, Rome, Lockport, Port Henry and Plattsburg. Plans were prepared for terminals at Troy, Erie basin at Buffalo, Oswego and Watkins. Other sites approved by the Canal Board were Varick, Waterford, St. Johnsville, Cohoes and Ohio basin at Buffalo. All of the terminal contracts awarded thus far had provided for nothing more than dockwalls, terminal areas and harbor or approach channels. Warehouses and freight-handling devices were to be added and already studies for these essentials were being carefully made.

By the close of 1913 we find the State Engineer stating that 250 miles of completed canal were ready for use as soon as proper connections could be made with the existing canal. Among the completed structures aside from the locks were the movable dams in the Mohawk, the Delta reservoir and the dams at Vischer Ferry, Phoenix and Fulton.

In spite of former warnings that there was danger that the Federal government would not provide outlets at the canal termini by the time the canal should be completed there were two of these places, Whitehall and Oswego, where nothing beyond making investigations and reports had been accomplished. In the Niagara river the Government had done some work, but it was still to be decided how much it would do at Tonawanda. At Troy construction was progressing. It was very important that work at all these termini should be undertaken without more delay and so State Engineer Bensch in his 1913 annual report again and most earnestly urged the Legislature to give the subject careful attention and to memorialize Congress, setting forth the necessity for immediate action.

A law of 1913 authorized the Superintendent of Public Works to close such portions of the Oswego canal between Barge canal lock No. 2, at Fulton, and Lake Ontario during the year as in his judgment might result in expediting the work of construction.

Among the canal contracts awarded in 1913 was one for an important section of canal now for the first time put under contract. This was the channel at Medina. The elaborate tests made in 1910 on models of a concrete arch aqueduct will be recalled. The idea of carrying the canal over the gorge by aqueduct or otherwise was finally abandoned and instead it followed the old alignment through Medina, employing an exceptionally wide channel to compensate for lack of easy curves and requiring immense retaining walls where it circled the gorge. In the year's list were also two contracts for finishing work left uncompleted by former contractors, one a section near Utica and the other a portion at Mechanicville. Ten bridges were included, four of them being on the stretch between Syracuse and Oswego, three at villages in the western part of the state, one at Little Falls and another near by and one across the Seneca river at Howland island. Three contracts for electrical operating machinery were awarded and the remaining work to be let included a guard-gate near Crescent dam, steel sheet-piling at various places on the Rochester-Lockport level and the delivery of lumber and piles at Bushnell's Basin.

Both 1912 and 1913 were years of large accomplishment in canal construction, just as 1911 had been and as 1914 too proved to be for that matter. These were the banner years of construction, the central period of activity, when nearly all parts were under contract and the great bulk of work had not yet been finished. In explaining why more was not done in 1913 the State Engineer said

that one cause of delay was the litigation connected with the railroad crossings.

In 1914, just before long stretches of river canalization were about to be opened to traffic, we find canal officials considering a new feature of construction, that of aids to navigation, such as lights, buoys, lighthouses and the like. In the old canal the channel ran generally in land line, bordered on both sides by immediately adjacent banks; in the few river sections it hugged closely the bank on which the towing-path was built. In channels of this character a navigator must have been grossly careless to run aground, but in the new canal, nearly three-quarters of which lay in canalized lakes or rivers, conditions were entirely different. Somewhere in the broad expanse of these lakes and rivers a comparatively narrow channel had been excavated and usually in the rivers there was not sufficient depth for navigation outside of this channel. It became imperative therefore to mark the limits of the channel carefully and in 1914 Superintendent of Public Works Peck carried on some experiments with lighted and spar buoys, endeavoring especially to devise a suitable type of light. The proper color scheme for lights and buoys also demanded considerable thought. The Federal government had adopted a rule that a certain color should be used on the right and certain other colors on the left side of a channel in proceeding upstream. As Federal waters adjoined the canal in several places it was expedient to conform to the Federal rule, but the difficulty arose that in doing this the colors would change sides while continuing in the same direction, since summit and depressed levels would be encountered alternately. The final decision was to regard the whole canal system as proceeding upstream in going away from tide-water, without respect to actual physical conditions. With this understanding a navigator on a trip away from the ocean finds red buoys and red lights on his right and black buoys and white lights on his left.

Two other features to occupy the Superintendent at this time were the method of making repairs to lock gates and a better means of protecting these gates than was provided by the buffer-beams. We find him recommending the purchase of portable cranes for handling damaged gates and also a type of protection like that used on the Panama canal, which is a chain that does not stop a boat abruptly, like a buffer-beam, but is paid out gradually by an automatic release until the boat comes to a stop.

In 1914 the Superintendent of Public Works was permitted by a legislative act of the same year to close such portions of the Oswego

canal as he deemed expedient. The plan, practiced since 1909, of keeping the Oswego canal closed during a part at least of each navigation season doubtless hastened considerably the completion of the waterway, and in spite of this procedure the traffic did not seem to suffer.

Because of the political change which occurred in 1911 we examined closely the status of canal construction at that time. So now again, at the time of the next change in administration, we shall see how the record stands. State Engineer Bensel in his annual report for 1914 tells what had been accomplished thus far. Virtually all of the important structures except two near Rochester and a lock at Mays Point had been completed or were within a year of probable completion. Included in the list were the movable dams in the Mohawk river, eight in number, the fixed dams in the Mohawk at Vischer Ferry and Crescent, the dams in the Oswego river at Oswego, Minetto, Fulton and Phoenix and in the Seneca at Baldwinsville, the movable dams at Cayuga and Waterloo, the fixed dam at Seneca Falls, the three dams in the Hudson river near Mechanicville, two of them fixed and one in part movable, the several locks and appertaining structures, and the two large storage reservoirs, that at Delta being completed while that at Hinckley was within five per cent of completion.

Mr. Bensel said that the Erie canal from Waterford to Three River Point and the Oswego canal thence to Oswego was so far advanced that by the spring of 1916 it should all be completed to Barge canal dimensions, thus giving passage from the Hudson river to Lake Ontario. The Erie from Three River Point to the Montezuma aqueduct and also the connecting channel between Onondaga lake and the Seneca river were still farther advanced and should be finished by the spring of 1915. Between the aqueduct and Lyons there had been delay on account of the existence of several railroad crossings. From Lyons to a point a little east of Rochester the canal was virtually completed except at the crossing of Irondequoit creek, the place where the serious break occurred in 1912. From the point east of Rochester to a point about four miles west of the city, a distance of some eleven miles, canal work was about half done. Within this stretch eight railroad crossings were encountered and because adequate provision had not been made for these crossings in the original contracts, said Mr. Bensel, great delay in advancing construction work had resulted. From the point four miles west of Rochester to Tonawanda, approximately a hundred miles, the canal might be said to be entirely com-

pleted, the unfinished parts being small pieces of work which could not be done until immediately prior to the time of opening the whole new canal in that part of the state to navigation. At Tonawanda there was a short extent of canal to build before entrance into the Niagara river might be had, but it was considered that this section could be completed in a short time.

The northerly portion of the Champlain canal, from Lake Champlain at Whitehall to Northumberland, a stretch of thirty-five miles, had already been opened and used for navigation during the season of 1914. The remainder had reached such a stage, said Mr. Bensel, that it seemed probable that it would be so nearly completed by the spring of 1916 that traffic could be turned in, even though certain small sections might not have the full depth of twelve feet. The portion of the Cayuga and Seneca canal from its junction with the Erie branch to Cayuga lake and on through to Ithaca would be entirely completed by the spring of 1915. Work on the remainder, the section between Cayuga and Seneca lakes, was rapidly approaching completion and by the spring of 1916 should be ready for opening to navigation.

It would appear from this recital that most of the canal should have been put in operation in the spring of 1916, but it will be seen presently that the forecast was entirely too optimistic. It was only by almost superhuman efforts that the canal throughout its whole extent was opened to navigation in the spring of 1918.

In this catalogue of accomplishments by the State Engineer there are one or two things which should have special attention. One is a discussion of what he called the northerly and the southerly routes in the vicinity of Lyons. He said that when he assumed office he found contracts in force for a line north of the railroads and that early in 1912 he made a thorough study of the situation with a view to a possible change of location. Finding, however, that if the change should be made at that time all that had been done theretofore would be wasted and also the State would subject itself to claims for loss by the contractor, he decided to continue along the line already begun. But in his opinion the other route would have been better, in that it eliminated several railroad crossings and also some crossings of the old canal alignment and moreover would have cost considerably less. Furthermore work upon the section would have been nearer completion.

Another subject is that of railroad crossings in general throughout the whole canal project. During all of Mr. Bensel's administration it was apparent that in the matter of railroad crossings he

and also his associates on the Canal Board were not in accord with their predecessors. The early policy in regard to railroad crossings was one of the first things he criticised and to delays by reason of these crossings he attributed much of the lack of better progress during his administration. From a statement issued by the incoming State Engineer it will be seen presently that questions raised in 1911 as to the legality of former negotiations between the Canal Board and the railroads had thrown the matter into the courts, where after three years of litigation the original settlements were upheld. This decision was handed down by the Court of Appeals in 1914 and in his report of that year Mr. Bensel said that the extent of the State's liability having thus been determined the way was open to satisfactory agreements and also to putting an end to further delay. Throughout the whole period of construction the railroad crossing problem has been one of the most troublesome. It would seem that the stand taken in 1911 retarded rather than hastened operations.

In his report of 1914 we find the State Engineer again urging upon the Legislature the need of persuading the Federal government to make haste in beginning work at the Barge canal termini. The channel in Lake Champlain north of Whitehall was both shallow and exceedingly tortuous and although it involved no great amount of work its improvement was very necessary. In the situation at Oswego a new factor comes to light in this report. Between the end of canal construction and the point where the project of Federal improvements ended there was a distance of about a thousand feet. Although this stretch was regarded as being under Federal jurisdiction the existing Federal project was interpreted not to include it. The State Engineer suggested that the Legislature might be called upon to authorize the State to do this work.

Another item of interest in the State Engineer's report was a recommendation that the Legislature take steps to provide for suitable management and operation of the canal, now so nearly completed. In this connection Mr. Bensel called attention to the fact that the new canal demanded radical changes in the method of management and also an entirely different grade of men in its operation.

A large number of contracts was let in 1914. The erection of steel structures made up the bulk of the list, there being more than a score of bridges, some of them large and important. These included the superstructure for the movable dam at Scotia and highway bridges at Rome, Amsterdam, Crescent and Brewerton. Other

types of steel construction in the list were guard-gates, Taintor gates, lock gates, lock valves and the strengthening of seven of the movable dam superstructures in the Mohawk. Three contracts were for completing work left unfinished under earlier contracts, the stretches being that between Crocker's Reef and Fort Edward, that from Mindenville to Little Falls and that between Fox Ridge and the Montezuma aqueduct. Under other contracts of this year were included the electrical operating machinery for the Cayuga and Seneca canal, a dam at Trenton Falls, channel excavation at Waterloo, a stretch of channel at the eastern extremity of the Erie canal, some piling at the movable dam at Rotterdam, the filling of the old canal at Fulton, the removal of buildings at Seneca Falls, the making of closures in the Vischer Ferry and Crescent dams and the removal of the Crescent aqueduct. Eight new terminal contracts were awarded, among them those for some large and important terminals. The sites included Troy, Erie basin at Buffalo, Gowanus bay in New York city, lake terminal at Oswego, Crescent, Thomson, Constantia and Schuylerville.

But the subject that was uppermost in the canal affairs of this period has not yet been touched upon—the exhaustion of the appropriation before the completion of the canal. The prospect of this event was pointed out in 1912, two years before the incidents we have just been discussing, but we purposely refrained from mentioning this warning in its proper chronological setting, in order that the entire matter of exhausted and new funds from beginning to end might be treated all together.

All through the early years of constructing the Barge canal the engineers steadfastly guarded against overrunning the preliminary estimates. It was the engineers who had made these estimates and many of the same men who had been employed during the preliminary stages were engaged in building the canal, and in a way they all felt a personal responsibility for not exceeding the estimates. Perhaps the feeling that their professional honor and their reputation for accuracy were at stake was a more potent agent in inducing strict economy than was even their duty to the State, sacred as that was considered. The odium of the nine-million project had fallen largely upon the undeserving heads of the engineers, and these men did not desire a like experience, for they realized that failure to complete the canal within the original appropriation would put them on the defensive and no matter how blameless, censure was almost sure to follow.

The law which ordered the preliminary survey in 1900, reflecting public disapproval of the late fiasco, had directed that the plans and estimates should be made with as much care as for actual construction. One who is familiar with the numberless details of preparing contract plans for large and intricate engineering projects knows of course that, considering the immensity of the proposed waterway and the limit of time and money available for preliminary investigations, this law was asking the impossible. The resulting estimates, however, as revised in 1903, have proved to be much more accurate than is usual on undertakings of comparable size.

But watchful as had been the engineers, unprecedented increases in the cost of labor and materials, the placing of unexpected burdens upon the appropriation by legislative action, unforeseen difficulties and delays, changes of administration, and above all, enormous claims for damages followed by court awards on a considerable portion of them, all these conspired against the hoped-for accomplishment and additional moneys had to be sought in order that the canal might be completed.

Up to about 1912 the public seems to have had no thought that the whole enterprise could not be finished within the original estimate. State Engineer Bensel was the first to intimate that this expectation was futile. In his annual report for 1912, transmitted to the Legislature on January 7, 1913, he stated that after thorough investigation he had reached this conclusion. The main deficiency in the estimate he found to be in the items for appropriated lands and damages for water-powers and riparian rights. The actual cost of building the canal, he thought, together with the engineering expenses for preparing plans and supervising construction, would come within the estimated amounts for such items.

This disclosure did not have the effect of causing the Legislature to take any immediate steps to supply additional funds. In fact Mr. Bensel repeated his warning in two succeeding annual reports, those for 1913 and 1914, presented to the Legislatures of 1914 and 1915, respectively, before any such action was taken. The public, however, took cognizance of the statement and was inclined to criticise. But the fault, if fault there was, appeared to lie largely in failure to foresee court decisions. These had made large awards for damages and also had placed on the State the burden of other unanticipated expenditures. There was nothing therefore that the people could do about the matter.

In studying this period and especially in reviewing this incident of exhausted funds it must be remembered that canal construction

was begun and finished under the administration of one political party, but that there have been two periods, one of two years and one of four years, when the opposing party has been in immediate charge of canal affairs. It was at the middle of the four-year period that the State Engineer sent his first report to the Legislature telling of the need of additional funds. It was to be expected therefore that such a revelation would be used for partisan ends and that whatever was said might be colored by party feeling. Furthermore the year 1913 was one of unusual political turmoil. The Legislature, convened by the Governor in extraordinary session in June, remained in session the rest of the year and meantime removed the Governor from office.

On December 10, 1913, a resolution was introduced in the Assembly, which, although it did not become effective, shows somewhat the temper of at least one faction of public sentiment. After reciting that announcement had been made that the canal could not be completed within the original appropriation, that a former State Engineer had said that it could be so completed, that it had been charged that contractors had been permitted to abandon contracts after having excavated earth for which they had been paid an average earth and rock price, that funds were said to have been applied from the appropriation toward work not contemplated in the original plans, and that large sums were alleged to have been expended for emergency work under extra and unspecified work orders, the resolution called upon the State Engineer to present to the 1914 Legislature a report in answer to certain questions.

A perusal of these questions will help to an understanding of the whole situation and so we quote them. Although the resolution was not concurred in by the Senate and had no authority to draw an answer from the State Engineer, nevertheless he did in substance respond to it and his answer was contained in his annual report to the Legislature of 1914. But before we quote the resolution we must notice what the State Engineer retiring from office at the close of 1910 had said concerning canal completion. A knowledge of this statement is necessary to an understanding of the resolution.

"At the end of another year," said the State Engineer in 1910, "I repeat the statement that the whole canal can be built within the original appropriation. Since 96 per cent of the entire length of the canal is under contract at prices aggregating between two and three million dollars less than the appropriation for these pieces of work and since a contingent fund of about four million

dollars, included in the original appropriation, has not been drawn upon, this prediction seems well founded."

The latter part of the Assembly resolution reads as follows:

"Resolved (if the Senate concur), That the State Engineer and Surveyor be and hereby is requested to present to the Legislature of 1914, upon the day on which it convenes, a detailed report showing:

"1. What has been the expenditure during his term of office for actual construction work. How much has been expended under the title of emergency work and extra or unspecified work orders.

"2. How much has been paid from funds accruing from bond issues under his administration for engineering expenses and a detailed report of what those engineering expenses include and how far the Civil Service regulations have been complied with in the expenditure of such money, and a further detailed report of the expenditures of all moneys not actually paid to contractors for construction work.

"3. What contracts have been cancelled and relet in the course of his administration. What has been the extra expense to the State thereby and what attempts have been made to hold the contractors failing to complete their contracts liable on their bonds, and what was the loss to the State by reason of delay.

"4. That he also report what has become of the contingent fund of \$4,000,000 referred to in the report of Frank M. Williams, December 31, 1910, and the \$3,000,000 excess created by the letting of contracts at prices less than the original appropriation for that specific portion of the work.

"5. That he give the Legislature a full statement of all new contracts let during his administration, the amount of work covered by these contracts and a statement of the cost of work under such contracts as compared with the cost of similar work under previous administrations.

"6. That he also render a statement of any and all supplemental agreements during his administration of changes in original contracts or whether the cost of construction was increased or decreased thereby and how much.

"7. That he render a statement of all contracts or work done during his administration without competitive bidding and of all competitive lettings of contracts. How many competitors put in bids. What those bids amounted to and whether the contract in each case was let to the lowest bidder.

"8. That he state how much money will be required to complete the canal, without reference to claims for damages, the acquirement of lands or the payment to riparian owners and when, in his opinion, work on the canal must cease for lack of funds unless there be a further appropriation or bond issue."

The State Engineer's gratuitous response to these questions explained the situation at considerable length. (Anyone desiring the details may find them in the report for the year 1913 and again in a somewhat similar review of the status of canal affairs in the next year's report.) The State Engineer had a few criticisms for the work of the earlier years. He said that contracts for work crossed by railroad lines had been entered into before he took office and he found that these made no provision for new crossings or placed the contractors in possession of the sites at such crossings; also that, had certain contracts been carried out according to the plans on which such contracts had been let, navigation on the existing canal would have been destroyed. These were among the things that had caused delay. But on the other hand he paid a signal tribute to those who had made the preliminary estimates and this is the more noticeable because they were men with whom he had strong political differences. He said that he had "no hesitation in stating again that seldom if ever [had] a work approximating the magnitude of the Barge canal improvement been carried to completion at a final cost for construction so near to that originally estimated as [would] be the result on the Barge canal."

At the beginning of 1915 the incoming canal administration was confronted with an appropriation more than exhausted after existing obligations should be met and a waterway only about 85 per cent completed. State Engineer Williams at once issued a statement setting forth conditions as he found them and urging immediate action, in order that such an important undertaking might not fall short of completion by so little nor even be delayed in its progress. This statement, though somewhat long, tells so lucidly and so succinctly just what is needful for a clear understanding of both the whole financial situation and its causes that it seems best to quote it here substantially in full. The quotation comes, however, from the annual report for 1915, which contained the statement given out in January of that year but changed the figures slightly to suit the difference in date. It also describes what action the Legislature took to meet the emergency.

"Upon taking office on January 1, 1915," said Mr. Williams, "I found, as had been reported by my predecessor, that the appro-

priation made for building the Barge canal would not be sufficient to complete the work.

"This appropriation was based on an estimate made by the State Engineer in 1903. According to this estimate the work involved in constructing the canal would cost approximately \$84,000,000. The balance of the appropriation was designed to cover damages, engineering, incidental expenses and contingencies.' It was estimated also that \$2,000,000 would be realized from the sale of abandoned canal lands, which would no longer be necessary to the State because of deviations from the line of the old canal in the course of new construction. This \$2,000,000, it was estimated, would be turned into the canal fund for the general uses of the appropriation, thus making the estimated total cost of the canal \$103,000,000, of which \$2,000,000 would be recovered. About 90 per cent of the construction of the canal channel with its locks and smaller structures has now been completed, and I estimate that the total cost under this head will amount to \$90,000,000,* thus overrunning the original estimate for actual construction by about \$6,000,000. The principal reasons for this shortage in the original estimate are shown in the following seven paragraphs:

"In 1905 the Legislature amended the original Barge Canal Law, giving power to the Canal Board to increase the width of the locks from 28 feet, as originally provided, to 45 feet, thus adding to the cost of construction about \$2,500,000 without increasing the appropriation. Several other amendments passed by the Legislature added \$250,000 worth of work without at all increasing the appropriation.

"During the prosecution of the work up to 1911, the Canal Board negotiated settlements with the railroads whose lines were crossed by the new canal, providing by such settlements for the necessary changes in railroad grades and alignments and necessary railroad bridges. Soon after the advent of a new State administration in 1911, the legality of the agreements already made and future agreements on the same basis was questioned, thereby throwing the matter into the courts. After three years of litigation the Court of Appeals upheld the legality of the settlements made. This litigation, however, had made it necessary to cancel several of the existing contracts, for the reason that it was not possible to provide the contractors with the entire site of their work. Other contracts were canceled by the Canal Board on the representation by

* For the total cost of construction work and the statement concerning the reason for a further increase, see the chapter containing tables of contracts.

the Superintendent of Public Works department that the prosecution of such contracts under the existing plans would make impossible the maintenance of navigation on the present canals, for which the Superintendent of Public Works is responsible. Another class of contracts which has caused a distinct loss to the State includes those on which the contractors have been unable to complete their work because of financial difficulties and on which the State has been compelled to enter and finish the uncompleted construction. This has involved the reletting of the balance of the work under new contracts, the State holding the bonds of the original contractors as a protection against increased cost. In the meantime many of the bonding companies have failed, making recoveries on some of the bonds doubtful. As the contractors in all cases mentioned above had completed a portion of their work, as the portion thus done was usually the most favorable part and as the cancellation and reletting involves much additional expense, due to resurveying, readvertising and the movement of heavy machinery and damage claims, I believe that the appropriation has suffered through these causes to the extent of over \$4,000,000, in addition to the overhead charges for running the various departments, which should not be estimated at less than an additional million dollars.

"Other reasons for the increased cost of construction over the 1903 estimate will be found in the increased cost of materials, particularly cement, in the Eight Hour Labor Law and in the Workmen's Compensation Law, both pieces of legislation passed subsequent to the making of the estimate in 1903. All of these causes have increased the construction cost to a very considerable amount, but just how much it is almost impossible to estimate in actual figures. The practical working out of this legislation will have to be taken into account in making any further estimates. The 1903 estimate of the cost of constructing these canals will prove to be closer to the mark than is usual in engineering works of like magnitude, as, for instance, the Panama canal; and the State Engineer's department of 1903, headed by State Engineer and Surveyor Edward A. Bond, is entitled to credit for the closeness of its construction estimate.

"Many charges have been made against the original appropriation under the head of incidental expenses which were not contemplated by the 1903 estimators. The necessity of maintaining navigation on the old canal while building the enlarged channel on the same site, as is the case in many sections, presented a number of unexpected and expensive difficulties.

"Two serious breaks have occurred in the canal east of Rochester, one in 1911 and one in 1912, which have already cost about \$400,000, and for which permanent repairs will entail an expense of \$250,000 additional. These expenses, together with others arising from the necessity of maintaining navigation in the old canal while the new channel is being constructed, have been paid by the Department of Public Works out of the 101-million appropriation. The duty of rebuilding highways destroyed by construction operations has also devolved upon the Superintendent of Public Works, the cost of which he has paid out of this appropriation, and the total expenses of that department charged against the appropriation have amounted to \$1,387,525.17.

"Injunctions on the part of property owners which delayed work or made necessary the readjustment of plans have also added to the expense.

"The department of the Comptroller has charged against the appropriation \$375,631.10, while the Claims Department and the appraiser's expenses have amounted to \$461,751.25.

"The original estimate did not take into consideration the necessity for many of these expenditures.

"The total charge for engineering, including the charges for Consulting Engineers, amounts to \$9,726,423.64.

"Under the head of property damages no provision was made in the 1903 estimate which at all adequately provided for the enormous damage claims which have been filed nor even for the awards which have been made to date, such awards now amounting to \$11,955,619.55. The above amounts show expenditures under the various classifications as of December 31, 1915. It was not contemplated that the various power developments encountered on the rivers to be canalized, which had been made possible in many instances by the use of waters retained by State dams, would be entitled to damages when these dams were altered to suit the requirements of the new canal. The total amount originally estimated for such damages was less than \$200,000. More than this amount was awarded by the Court of Claims in a single water power damage case. Nor was it expected that the land damage could rise to so high a figure. Moreover it was not expected that the adjudication of these various claims for damages would drag through so long a period of time, involving on the part of the State considerable expenditure for interest charges.

"On January 1, 1915, the State had under contract, work which at contract prices would cost a little over \$6,500,000 to complete.

The total expenditures charged against the 101-million appropriation up to January 1, 1915, amounted in round figures to \$96,000,000. It is apparent, therefore, that the State was at that date obligated to an expenditure of \$1,500,000 more than was available in the appropriation. The contracts then in force were of great importance and I estimated that to cancel them at that time would involve the State in a loss of approximately \$5,000,000 unless the work was to be permanently abandoned, when the loss would have to be measured by the damage claims of contractors, plus the greater part of the \$101,000,000 already expended.

"I promptly reported this condition of the appropriation and urged that immediate steps be taken to correct a situation which appeared to be in direct violation of the Finance Law. On April 24, 1915, the Legislature took action by making a direct appropriation for carrying on the work. In the meantime, however, the Board of Claims had handed down a number of decisions involving damages against the State and on April 1, I found that the over-obligation of the appropriation had increased to over \$3,000,000. It was necessary to make provision to cover this over-obligation as well as the amounts necessary to carry the running expenses of such departments as were charged with carrying on the work, and accordingly the Legislature of 1915 appropriated the sum of \$3,654,000 to provide for the completion of contracts that had been let prior to January 1, 1915, and for the attendant necessary departmental expenses. This appropriation did not permit of the letting of any new contracts.

"I estimated as of date of January 1, 1915, that to complete the Erie, Oswego and Champlain canals in accordance with the requirements of the law as it then stood would require the additional sum of \$27,000,000. This estimate includes the completion of construction, engineering, incidental expenses of other departments and the settlement of damage claims of various kinds. The amount required to cover such damages is very difficult for me to determine accurately, particularly as the adjudication of such damage claims is in the hands of departments other than that of the State Engineer.

"The Legislature, therefore, passed an act submitting to the people for disposition the question of issuing additional bonds to the amount of \$27,000,000 for the completion of all work contemplated under the previous act, and for the settlement of damage claims arising by reason of canal construction. Provision was made

that in the event of raising \$27,000,000 by bond issue the \$3,654,000 should be refunded to the State treasury."

As on other occasions when canal legislation or organized public endeavor were needed, the executive and legislative committees of the State Waterways Association were on hand to help. At first the advocates urged the Legislature to make a direct appropriation for the entire amount necessary to complete the canal, but that proposition was refused. Then they suggested the appropriation of enough money to put under contract all sections which would require two years to complete and that too was refused. Finally the Legislature decided to appropriate a fund sufficient only to complete existing contracts and to submit to the people a referendum for a \$27,000,000 bond issue, the sum named by the State Engineer as the amount needed to finish the waterway and settle the damage-claim awards.

Later in the year the Waterways Association helped by organizing and carrying on an energetic campaign of education in support of the referendum. The assistance of commercial bodies in New York and other cities was secured and considerable interest was aroused, sufficient to pass the measure by a majority of 44,917 votes.

That we may know just what the people were voting on, it will be well to refer to the presentation of the case as it was made by the *Barge Canal Bulletin* a week or two before the electorate gave its decision. The article is terse and directly to the point, especially the conclusion. A few of the more telling excerpts are chosen.

"At present," reads the *Bulletin*, "the work of constructing the Barge canal is about 90 per cent completed. Although it is so nearly finished, the uncompleted portions are so located that the usefulness of the enlarged waterway cannot be realized without their completion. On the stretch between the Hudson river and Lake Ontario one uncompleted contract forms the chief obstacle to the opening of navigation along the new route. Also, on the Champlain canal a single contract forms a similar obstacle.

"Of the \$27,000,000 carried in the referendum practically one-half is for the settlement of awards for damage claims. The situation in regard to these damage and property claims seems not generally to be understood. It should be realized that the policy already adopted by the State has obligated it to pay these awards, and if funds are not provided by the sale of bonds, money must be appropriated by the Legislature within the next year or two, to

meet this obligation, and probably this money would have to be raised by direct taxation.

"From the other half of the \$27,000,000 the \$3,654,000 appropriated by the 1915 Legislature must be deducted, leaving \$9,846,000 for the work of construction and its attendant expenditures. The reasons for the canal costing more than originally estimated were clearly explained in a statement by the State Engineer, printed in the January *Bulletin*. It was there shown that the cost of actual construction would overrun the estimate by only \$6,000,000, in spite of the fact that \$9,000,000, not included in the original estimate, had been added by legislative acts, by delays and contract cancellations due to court decisions and by expenditures for repairing breaks and maintaining navigation in the old canal, and in spite of the additional fact that the cost of labor and materials has largely increased since the estimate was made in 1903. It was also stated that the chief discrepancy in the original estimate was in the item of property damages, there being no precedent at that time to indicate that the courts would uphold enormous power development claims nor award such high land damages. Already awards to the amount of over \$10,000,000 have been made and, as stated, another large sum is required.

"To understand fully the situation, it may be well to consider what would happen, should the people fail to approve the \$27,000,000 referendum. It would mean that the State would fail to realize any return for a present investment of over \$100,000,000, at least, until some means of completing the project should be devised, and annual interest charges would be going on meantime. . . . Failure to pass the referendum would mean also that about \$13,500,000 would have to be raised, probably by direct taxation, to meet the State's obligations in settling awards. It might mean, too, that the Legislature would feel obliged to appropriate the \$10,000,000 necessary to complete the canal (possibly in several yearly installments) and such action would probably necessitate additional direct taxation. . . .

"Briefly, in conclusion, the decision to be made by the voters this fall resolves itself into the following simple question: Shall the State raise a little less than \$10,000,000 by bond sale to complete its canal project in the shortest possible time, and \$17,000,000 more, \$13,500,000 of which it is already obligated to pay and must raise in some way, and \$3,654,000 of which will go back into the treasury; or shall the work be halted, the expenditure of more than \$100,000,000 bring no return, interest charges of \$4,000,000 or

\$5,000,000 be paid each year on a useless investment and \$13,500,000 be raised by direct tax rather than by bond issue to meet unavoidable obligations? It will be seen that the real question centers on the \$10,000,000, an amount, it should be noted, about equal to interest charges for the two years needed for the entire completion of the project."

With the coming of a new administration in canal affairs as well as in State governmental affairs in general there were several changes in organization. But the new administration in the State Engineer's department was merely the return of an old administration, Mr. Williams having been State Engineer in 1909 and 1910 and before that a member of the department engineering force for many years. Soon after he took office he found that he could make a large reduction in the number of engineers without jeopardizing the efficiency of the corps and so he reduced the force. For one thing he dispensed with the separate terminal organization, merging it with that earlier effected for canal construction and thereby saving a duplication of several high-salaried officials. To the office of Superintendent of Public Works came Gen. W. W. Wotherspoon, a man of national fame in army affairs.

An important section of new channel, that from Waterford to Rexford, was ready for opening in the spring of 1915 and because this was the portion that emerged from the Hudson and began the route across the state and also because it was an unusual section, containing the greatest series of high lift locks in the world as well as other interesting structures, it was decided to make a gala occasion of the opening day. This occurred on May 15 and the ceremony consisted in the passing of a boat bearing State officials through the Waterford series of locks and on through the new body of water formed above the Crescent dam. On board were Governor Whitman, Secretary of State Hugo, State Engineer Williams, Attorney-General Woodbury, State Treasurer Wells, Superintendent of Public Works Wotherspoon, the Governor's military secretary, the deputies, secretaries and chief assistants of both the State Engineer and the Superintendent of Public Works and a few others. A second boat carried press representatives.

The people of Waterford, where the officials embarked, welcomed the Governor and his party as they arrived by automobile. Amid decorations and waving of flags, to the sound of ringing bells and less musical whistles, the party alighted in front of the village officials assembled at the town hall and then, between lines of about six hundred school children, flanked by most of the population of

the village and near-by localities, it passed to the waiting boat, escorted by a band of musicians and a troop of Boy Scouts.

Before this new section of canal could be put into use it had been necessary to demolish the aqueduct which carried the old canal across the Mohawk river at the village of Crescent and also a final section of the Crescent dam had to be built. Not until Superintendent Wotherspoon was well assured that the new line would be ready in time did he give the orders to make the closure and destroy the aqueduct. This aqueduct, by the way, consisting of twenty-six masonry arches supporting a timber trunk, was erected about 1842. The Superintendent's order was signed on April 15, just a month before the day set for the opening.

In 1915 navigation was open for the full season on the Oswego canal for the first time since 1909. All the new locks were in operation and the new channel was available, but as yet it could accommodate boats of only six feet draft.

There was no money available for new work in 1915 and so no new contracts on the Erie, Champlain and Oswego canals were offered for letting. But the State Engineer had faith to believe that the people would vote the additional appropriation and so he prepared plans for the remaining contracts, thereby saving considerable time and being ready to begin construction almost as soon as money from the new bond issue became available.

But the terminal and the Cayuga and Seneca funds were not exhausted and a few contracts for these projects were awarded during the year. Most of the Cayuga and Seneca canal was already under contract, however, and only two minor pieces of work were let — one for removing buildings in Seneca Falls and one for two bridges in the vicinity of Waterloo and Seneca Falls. Of the terminal contracts new ones were awarded for terminals at Cleveland, Canajoharie, Weedsport, St. Johnsville, Tonawanda, North Tonawanda, Spencerport, Syracuse and Holley and for paving the Albany site.

In discussing the status of railroad crossings in 1914 we said that the problem of these crossings was one of the most troublesome of the whole canal project; also we called attention to the criticisms of the earlier policies and to the court decision that had recently been handed down. In his annual report for 1915 State Engineer Williams explains this whole railroad situation and he does it so clearly that the whole account, although it is somewhat long, is worth quoting. The importance of the subject demands a careful reading of this explanation.

"The points at which the Barge canal crosses the various railroad lines," said Mr. Williams, "have presented many intricate problems necessitating careful study on the part of this department. The whole matter has been complicated by the lack of definite judicial decisions clearly defining the rights and responsibilities of the parties at these crossing points. During my previous term as State Engineer, however, decisions had been made to an extent which satisfied the then Attorney-General, that in those locations where the Barge canal channel is planned to deviate from the channel of the existing canals, or from the beds of streams which are claimed to be navigable, the responsibility is upon the State to meet the expense of providing suitable crossings for those railroads which are thus encountered.

"Acting upon this principle some of my predecessors and myself concluded negotiations in respect to a number of railroad crossings falling under this head, and several important problems involving crossings were taken up and disposed of on that basis. The succeeding administration raised the question as to the legality of agreements of that nature and three years were spent in obtaining a decision which was finally handed down by the Court of Appeals, in effect, confirming the principle on which the agreements up to that time had been made. In the meantime, however, the State Engineer was unable to negotiate any new agreements, with the result that the whole project of canal construction was very seriously retarded.

"On assuming office one year ago it immediately became apparent to me that the disposition of a considerable number of such crossings, which remained undetermined and which constituted more than two-thirds of the total number, would influence, more than any other one factor of construction, the date on which the final completion of the canal could be consummated. With that idea in mind I at once began preliminary negotiations with the several railroads whose crossings of the Barge canal line had not yet been adapted to the requirements of that channel. These railroad crossings naturally fall into three classes.

"1st.—Crossings of 'Land Line' sections of the canal.

"2d.—Crossings of the present canals which must be enlarged to meet Barge canal requirements.

"3d.—Crossings of rivers claimed to be navigable.

"As to the crossings falling under the first head, it has been legally determined that the State must pay the full expense. The practical working out with the railroad companies of agreements

covering such crossings involves a great deal of negotiation covering the points as to what facilities shall be afforded, type of structures, allowance by the State for maintenance and renewals, and the granting of equitable rights to the railroad companies to operate their lines over such crossings. Inasmuch as the principal feature was to pay the railroad companies a fixed sum arrived at by agreement, they to perform the necessary work on and under their lines, much engineering detail has been involved. The stand early taken by the railroad companies that, in view of their liability to the public for accidents, they must have full control of any work on or under their lines of track, is in my judgment well taken and settlements have been made on that basis.

"In order to arrive at the amount which the State should pay, each of the crossings is taken up as a separate matter. Plans and estimates of quantities are furnished by the railroad companies, which plans and estimates are carefully checked over by this department and such modifications are made as are deemed proper from the standpoint of the State. The plans and estimates for a crossing having been agreed upon, a number of responsible contractors named by the railroad company and agreed to by this department are invited to submit sealed proposals for doing the work. The proposal of the lowest bidder if within the estimate of cost determined by this department is thereupon accepted as the basis of the amount to be paid by the State in full settlement of damages and to cover the construction work involved, such construction work to be carried on under the direction of the railroad company, thus relieving the State of any liability for possible accidents to trains. Under this method several important crossings have been determined upon by me and the construction begun. Negotiations covering all the remaining crossings under this class have reached a point which insure their completion within a very short time.

"Lacking judicial decisions it appeared to be an exceedingly difficult problem to determine the disposition of the crossings falling under classes 2 and 3. After considerable negotiation, however, with the New York Central Railroad Company which has a majority of the crossings coming under these heads, an agreement has been reached by me with that company, that having mutually determined the requirements covering clearances, foundations, and other details of the structures involved, the railroad company will proceed at its own expense to provide the necessary structures. The engineers of this department keep an accurate account of the

cost involved in the work on these crossings, and an agreement has been made between the railroad company and the State, that the question as to whether the railroad company shall ultimately bear the expense of the work thus done or the State shall be compelled to reimburse the railroad company for such expense, shall be determined by the courts.

"Under this plan several important crossings are now in progress of construction and preliminary agreements have been reached as to all those remaining, so far as the New York Central railroad is concerned. I am still negotiating with the other railroad companies concerning the crossings in these classes, and believe that they will follow the example of the New York Central Railroad Company in meeting this problem."

"One of the most important railroad crossing problems which has been successfully worked out by this department," continued Mr. Williams, "is the crossing of the New York Central main line at Lyons. The Barge Canal Law, chapter 147 of the Laws of 1903, provides that the route of the canal shall run from the mouth of the Clyde river 'up the Clyde river or any tributary thereof and through valleys, or portions of the present canal, on lines selected by the State Engineer, to Fairport.'

"At the beginning of my former tenure of office as State Engineer I found that several routes had been considered for a location of the canal in the vicinity of Lyons, but that no decision had been made as to which should be adopted. Not being entirely satisfied with any of the proposed routes I adopted a line which involved following the bed of the Clyde river through Lyons. Considerable opposition arose in certain quarters to this decision, and a line located on the hillside south of the village of Lyons was urged by many, including certain members of the then Advisory Board of Consulting Engineers. One of the principal arguments advanced in favor of this line was that it would be cheaper because the line following the Clyde river involved the crossing of the New York Central railroad east of Lyons station, and it was argued by those favoring the south route that this crossing would involve the necessity of raising at the expense of the State a large part of the New York Central freight yards at Lyons at an estimated cost of considerably over one million dollars. The objection to the south route, however, from an engineering standpoint was that it involved carrying the canal in embankment around the bend of the hill where the water surface would be seventeen feet above the level of the New York Central and West Shore tracks and the Rochester,

Syracuse and Eastern trolley line, all located within 200 feet of what would be the line of the canal. It seemed to me that the State would be taking unnecessary risks by such construction as a break at that point would result in a complete cutting off of all important rail communications running east and west. Moreover, my study of canal building had convinced me that better engineering practice would be followed by adopting the low-level line through this valley, keeping the canal on a line which would follow the thread of the stream, and thus obviate the necessity of embankments with an attendant loss of water by leakage and danger of breaks. Such decision is also in line with the best modern European engineering practice in canal construction.

"The contracts covering the construction of the canal in this vicinity were let a short time previous to the expiration of my former term of office, and work under such contracts was progressed for some time under the succeeding administration. These contracts, however, were all subsequently cancelled in an uncompleted condition because of the legal problems relating to railroad crossings in general, which applied to the crossing east of Lyons. I found, therefore, that the work of the canal in this vicinity was uncompleted and that no attempt had been made to solve the railroad crossing problem. I also found that many plans had been suggested for meeting this problem, but none were advanced which did not either involve the raising of the Lyons yards or the expenditure of so much money to avoid the raising of the yards that the total was prohibitive.

"Early this year I gave my personal attention to this matter and a thorough study of the subject convinced me that it was practicable to regulate the flow of the Clyde river by the construction of controlling works to be situated two miles east of the village of Clyde, which could be built at an estimated cost of \$14,600. By adopting this plan it became possible to carry the canal under the main line of the Central railroad at Lyons without affecting the freight yards. After considerable negotiation an agreement has been entered into with the New York Central Railroad Company for the complete construction of this crossing at an expense of \$329,656.60. I feel that this determination of the question entirely justifies the decision of the State reached five years ago from the standpoint of the only objection made to it, namely, that of expense, inasmuch as it is now clear that the route selected is not only in line with better engineering practice, but is also cheaper than would have been the so-called 'Southern Route.'

"My investigation which resulted in the determination to regulate the Clyde river by controlling works, also relieves the State of a possible expenditure of a quarter of a million dollars for the reconstruction of other railroad bridges lying between Lyons and the location of the controlling works."

It will be recalled that State Engineer Bensel had reported at the close of 1914 that the spring of 1916 should see the new channel open for navigation throughout the whole of the Champlain canal and also the Erie and Oswego stretches from the Hudson to Lake Ontario. This was found impossible of accomplishment and Mr. Williams' account of the reasons is enlightening. At the beginning of 1915, he said, there were two essential sections of the canal, one at Schuylerville and the other near Utica, which were not under contract, and as the fund was already over-obligated and additional money had to be appropriated to keep existing contracts in force, there could be no thought of letting these two contracts until after the people had voted another appropriation. In fact the Legislature had stipulated that the money furnished for carrying on existing contracts should not be used for new work.

The State Engineer's report for 1915 gives in compact form the status of canal and terminal construction at the close of that year and we paraphrase it. It appears that the northern portion of the Champlain canal, from Whitehall to Northumberland, 35 miles, had been practically completed and was opened to navigation in 1915. A contract for work between Northumberland and Schuylerville was about to be let. From Schuylerville to a point three miles above Waterford the canal was virtually completed, while the remaining portion, the three miles to Waterford, was sixty per cent completed.

All of the Erie canal from Waterford to Three River Point was completed except a section near Utica and also certain excavation between Jacksonburg and Herkimer and at Rome, New London, Sylvan Beach and a few points in the Mohawk river. The greater part of the uncompleted work lay west of Three River Point and this included the completion of the lock and dam at Mays Point, the completion of the canal from the Wayne-Seneca county line to Lyons, from the Wayne-Monroe county line to a point just west of Rochester and in a five-mile stretch through the Montezuma marshes, also the construction of the Rochester spur and the entrance into the Niagara river at Tonawanda. The State Engineer said that there would seem to be no difficulty in completing this western section of the canal by the opening of navigation in 1918.

He laid no special emphasis on this statement at the time but in the light of subsequent events it becomes important and we should remember it.

The Oswego canal was completed to full dimensions virtually throughout its entire length. The Cayuga and Seneca canal was finished with the exception of some excavation between Seneca Falls and Geneva and the completion of minor structures.

Concerning terminal construction at the close of 1915 the State Engineer said that on the Champlain canal dockwalls had been completed at Mechanicville, Thomson, Fort Edward, Whitehall, Port Henry and Plattsburg. On the Erie canal dockwalls had been completed at Albany, Troy, Crescent, Schenectady, Amsterdam, Fonda, Fort Plain, Little Falls, Herkimer, Ilion, Frankfort, Rome, Holley and Lockport, and construction was in process at Canajoharie, St. Johnsville, Utica, Cleveland, Constantia, Syracuse, Weedsport, Spencerport, Tonawanda, North Tonawanda and Buffalo. On the Oswego canal only one contract had been let, that for the lake terminal at Oswego and here work was under way. On the Cayuga and Seneca canal also there had been only one contract, that at Ithaca, where the dockwall had been completed. The time had come when warehouses and freight-handling machinery could be added to the terminal equipment and plans for doing this were nearly ready. At New York city, where nearly half of the terminal appropriation was to be expended, only the Gowanus bay terminal was under contract. The State Engineer said concerning the New York situation that in 1914 land had been appropriated for the construction of four terminals not mentioned in the terminal act; also that the appropriation was not large enough for construction at all the places specifically mentioned, to say nothing about the four additional sites. Pending the settlement of existing claims in New York the State was proceeding slowly in incurring new obligations.

In his report for 1915 the State Engineer again made his perennial plea for Federal coöperation at the Barge canal termini. To a casual observer reviewing the events of these years this subject, because of its continuous sameness and lack of results, might almost appear as an annual joke, but in reality it was farthest removed from this characteristic. The situation had become serious and still Federal assistance was withheld.

At the close of 1915 it was expected that by August 1, 1916, the new Champlain canal, with a channel of sixty feet minimum width and twelve feet depth, would be in use throughout its whole length.

But subsequent study showed that by speeding up construction and leaving a part of the work temporarily unfinished the canal could all be opened to traffic on May 15 and moreover by doing this the making of repairs on the old canal simply for part of a season's use would be eliminated. Accordingly this plan was followed and it was deemed that the saving thus effected in cost of repairs more than compensated for the necessity of deferring the contemplated size of channel for a year, especially as the time for passage from Whitehall to Troy was thereby nearly halved and the deeper river channel permitted an increase in size of cargo of about fifty per cent.

Also a long new section of the Erie canal, adjoining that opened in 1915, was first put in use on May 15, 1916. This extended from Rexford to Jacksonburg, all except a few short stretches being in the Mohawk river channel. Thus the 86 miles of new canal at the eastern end of the Erie branch were navigated during 1916. This extent, together with the completed portions in the western part of the state, made a total of 184 miles of improved Erie channel in use this year. In addition all of the new Oswego branch was in operation.

The only celebration connected with the opening of new channel in 1916 was one at Little Falls, held on June 30 and July 1, in honor of completing the new lock at that place. This structure has the distinction of having the greatest lift of any of the whole canal system and also of being, when construction was begun, the highest single lift lock in the world. Governor Whitman was at the celebration and made an address. The ceremonies included a pageant which consisted of a series of spectacles depicting various stages of progress — from the glacial age to the present time, which latter was denominated the period of prosperity.

We have seen that an additional appropriation was voted by the people in 1915 and also that the State Engineer had anticipated this favorable verdict and was ready, with plans prepared, to begin operations as soon as possible. Proceeds from the bond sale were not available till February, 1916, but shortly thereafter new contracts were awarded and construction was in progress. Among the contracts of the year were a large number for finishing work left uncompleted under former contracts. This work was rather widely scattered. There was a piece between Sterling creek and the Oneida county line, another near New London, one near Lyons, quite a stretch a little east of Rochester, sections on each side of the Genesee river, another east of Tonawanda, and one on the Cham-



Lighthouse on Oneida lake, at Brewerton. Three lighthouses, all similar in design — one at the east end, Sylvan Beach, one at the west end, Brewerton, and one between, on Frenchman's island — mark the two main sailing courses along the length of the lake, about 20 miles. Each lighthouse is about 85 feet high. Those at Sylvan Beach and Frenchman's island display occulting white lights of 1,500 candle-power; that at Brewerton carries a fixed red light of 1,000 candle-power.



plain canal between Stillwater and Northumberland; also the completion of the lock and dam at Mays Point and of the river bridge at Schuylerville. All this work had been placed under contract once before but most of the contracts had been canceled by State Engineer Bensel because of his inability to settle the railroad crossing problems. There were also contracts for bridges, some of them large and important. These were located at Minetto, Little Falls, Lockport and Northumberland and one, known as Freeman's bridge, was situated near Schenectady. Of the new work there were a few important pieces, such as the Rochester harbor, lighthouses and other navigation aids in Oneida and Onondaga lakes, a junction lock at Rome and another at Mohawk and the channel at Oswego, which the Federal government had failed to dredge. The other pieces were small and of less account. These latter included dredging in the canal basin at Albany, a spillway at Waterford, governor equipment at the Crescent power-house, an apron at Vischer Ferry dam, a widening of channel at Canajoharie, repairs to the dam at the same village, channel completion at old canal intersections between Jacksonburg and Herkimer, repairs to the dam near Cayuga, sewers at Rochester, bank protection north of Waterford, a channel widening where the Hoosic river enters the Hudson and a diversion channel for Bond creek, near Fort Edward. New terminals put under contract in 1916 were those at Pier 6 and Greenpoint in New York city, Lyons, Rochester, Medina, Ohio basin at Buffalo, Rouses Point and the river terminal at Oswego.

We find the engineers giving considerable study to the larger kinds of navigation aids in 1916. Traffic was about to be turned into Oneida, Onondaga, Cayuga and Seneca lakes and plans for lighthouses, range lights, beacons, lights on breakwaters and large buoys for lake channels were demanding attention. But this was a subject in which there was an abundance of experience on other projects to draw from and conditions on the Barge canal were not so unusual as to present any very serious problems.

At the end of 1916 State Engineer Williams said in his annual report that in spite of steadily increasing difficulties in securing labor and structural materials and also in spite of delays in completing negotiations relative to work at Rochester and Tonawanda, he was still in hope of so progressing operations that the whole Erie canal could be opened in 1918.

In speaking again of the need of Federal coöperation at the canal termini the State Engineer said that it had become necessary for the State to undertake the work at Oswego. Although the

waters in which this work lay were under United States control, the Government did not seem disposed to do it and therefore the State had obtained permission from the Federal authorities to excavate the necessary channel, in order to assure through navigation between the Hudson river and Lake Ontario in the spring of 1917. Of the remaining termini, that at the Hudson river entrance was provided for. With the opening of navigation in 1917 there would be a full depth channel there. In the Narrows in Lake Champlain, just north of Whitehall, a depth of only ten feet was available and no funds had been provided for deepening the channel. At Tonawanda certain material should be removed in order to effect a proper connection between the Barge canal and the Niagara river.

The Cayuga and Seneca canal was ready for full navigation at this time and in 1917 would have been available for boats of the increased dimensions except for the lack of direct connection with the new Erie canal. To supply this lack a temporary junction lock would be necessary and its use would be of only short duration. It was decided that the advantages to be gained were not worth while and accordingly, until direct permanent connection could be made, boatmen were obliged to use the long, roundabout channel, which, however, accommodated nothing but small boats.

In connection with this statement concerning the Cayuga and Seneca canal the State Engineer added that there was a possibility that the total expenditures incidental to the improvement of this canal might overrun the appropriation — not that the cost of construction had exceeded the fund but that judgments against the State on account of property damage might more than exhaust the amount remaining of the original appropriation. The possible excess, however, in his opinion, would not be sufficient to require another referendum, but could be met by legislative appropriation, in the same manner as was customary in meeting other obligations of somewhat similar character.

Work not contemplated in the original Cayuga and Seneca scheme, the State Engineer explained, had been added without increase being made in the appropriation. It was intended at first to carry the canal through Seneca Falls without disturbing to any large extent the water-power or the manufactories of the village. In 1912 contract plans were approved which involved the wiping out of many power and business interests, thus bringing on the State liability for large damage claims. Moreover Cayuga lake inlet had been improved, although the law described the route as

going only to the inlet, and also the old Chemung canal between Watkins and Montour Falls had been improved, even though according to the original law the work was not to extend beyond Watkins. But this latter addition was ordered by a legislative amendment in 1911. These two pieces of work had cost \$450,000, exclusive of engineering, land damages and other incidental expenditures. It will be noticed that the State Engineer in calling attention to the reasons for the Cayuga and Seneca canal costing more than was estimated was speaking of events which occurred prior to his administration.

The work in the vicinity of Rochester was the last portion of any considerable size to be undertaken. From the very beginning of Barge canal building there had been trouble in coming to any agreement with the authorities of the city as to the whole scheme of construction in this locality. Then too there were several nearby railroad crossings to complicate the situation. These railroad crossings were the key to the situation. State Engineer Williams on his return to office vigorously set about the solving of these neglected problems. Finally, after nearly all other parts of the canal were either built or nearing completion, the controversy was settled to the satisfaction of all concerned and work had been rapidly pushed during 1916.

The main line of the canal runs through the southern outskirts of Rochester and the city is reached through a spur. A dam in the Genesee river near the heart of the city maintains the river level to form this spur and also creates the pool upon the surface of which the main canal crosses the river. Along the banks of the river were located railroad lines and at six places within a few miles railroads crossed the canal. South of the city the canal cuts through a park, which the citizens insisted should not be despoiled of its beauty. The Genesee is subject to severe floods and the people did not want this condition aggravated. The city on the one hand was striving to secure all it desired by way of improved conditions; the State on the other hand was endeavoring to keep down canal costs. It is not difficult therefore to see why discussions were protracted and agreements not easily reached.

As finally worked out the plans provided for dikes along the river banks adjacent to the park, drains to care for seepage which might filter through the dikes, foot and highway bridges of artistic design to span the canal in the park and the passing of a creek underneath the canal. In the river there was to be a movable dam, in part of the bridge type and in part of the submersible

sector type, and the river channel was to be bordered with walls high enough to prevent or at least lessen the possibility of damages by flood, the additional cost of constructing these walls to be assumed by the city. A canal terminal near the dam, long stretches of relocated tracks and the construction of a new railroad station were also included in the plans.

In his report for 1916 State Engineer Williams said that the subject of warehouses and machinery for the various terminals had been receiving considerable attention. Each terminal had been studied individually and its particular needs considered. He was proceeding with the idea in mind that rather simple freight-handling equipments should be provided at first and the volume and the nature of shipments should be allowed to determine the need of more elaborate machinery. Two new terminal contracts had been let for New York city, one for Pier 6, East river, and one for Greenpoint.

Also in this report Mr. Williams deprecated the policy which had dictated the hasty appropriation of valuable water-front property in New York city without any preliminary negotiations to establish a price and before plans and estimates had been prepared and contracts let which would require the possession of such lands. The opposite of this method had been the almost invariable rule on canal and terminal improvement elsewhere in the state, even in dealing with much less valuable property. The unnecessary interest charges thus created in New York city would probably run into hundreds of thousands of dollars. Up to the close of 1916 it had not been possible to effect settlements or have the courts pass upon the values of these lands and until this could be done and it was known how much money would be available for construction, contract plans could not well be made and no action could be taken toward locating terminals in other sections of the city.

With the opening of navigation in 1917 the portion of the new Erie canal from Jacksonburg to Three River Point was put in service. This was the goal which the builders had set for themselves during the preceding year. Together with the completed Oswego canal this gave passage now for boats of Barge canal dimensions from the ocean to Lake Ontario, the most easterly of the chain of Great Lakes.

The contracts let in 1917 were largely those incidental to finishing the channel in order that it might all be opened the following spring. There were two important new pieces of work — the mov-

able dam in the Genesee at the foot of Rochester harbor and the most westerly section of the canal, that at the Niagara river entrance. Nine bridges were in the list. These were at Scotia (the raising of an existing bridge), at Little Falls, near Sylvan Beach, at Phoenix and Lyons, two in Genesee Valley park at Rochester, at Tonawanda (an important bascule structure), and one at Clyde, which was more than a simple bridge, being called a viaduct. Two contracts furnished lights, buoys and posts for navigation aids. Three provided for finishing uncompleted work — the channel between Lyons and Newark, the prism at railroad crossings near Pittsford and the approach to a bridge in Schuylerville. The remaining contracts provided for hoists for bulkhead gates at Vischer Ferry dam, a dam in the old canal at Rome, the removal of the Montezuma aqueduct, an additional Taintor gate at the dam at Lyons, lengthening spillway and raising banks near Palmyra, rebuilding the power-house at Palmyra, machinery for the guardlocks at the Genesee river, a junction lock at South Greece, a drain at Brockport, cribs below locks Nos. 3 and 6, Champlain canal, and a cut-off wall at the Seneca Falls locks.

Among the terminal contracts of 1917 we find for the first time those for warehouses and machinery. The new terminals included Mott Haven and West 53d street in New York city, Cohoes, Albion and Middleport. The warehouses awarded were to be built at Albany, Troy, Schenectady, Amsterdam, Fonda, Fort Plain, Little Falls, Ilion, Frankfort, Utica, Rome, Newark, Spencerport, Holley, Albion, Medina, Lockport, both lower and upper terminals, Tonawanda, North Tonawanda, Mechanicville, Fort Edward, Port Henry and Whitehall. In the machinery contracts there were stiff-leg derricks for Albany, Little Falls, Rome, Lockport, Tonawanda and Whitehall, also two portable conveyors, one for Schenectady and one for Pier 6, New York city, and equipment for the terminal lock at Utica. In addition there was a contract for a 1,200-foot pier at Gowanus bay, New York city, one for paving at Rome and another for drains at Utica. The warehouses built at most of the places named in this list were known as temporary structures — not that they were not well built, but they were of frame construction rather than more permanent materials. The buildings at Albany, Whitehall, Fort Plain and Little Falls were called permanent warehouses, but the terminal fund was not sufficient to permit like substantial construction at many localities.

The year 1917 was one of most intense activity in canal construction. It has been seen that at the close of 1915 State Engi-

ner Williams had predicted that the spring of 1918 would see the whole new waterway open to navigation and also that at the close of another year he had said that there was still hope of attaining this end, although difficulties and delays had multiplied. Early in 1917 there came a new incentive. The United States entered the World war and the already congested traffic routes became hopelessly overwhelmed. It was vividly apparent that there was much need of such relief as could be given by a completed modern waterway along the route of greatest freight movement from the interior to the coast, and State officials and contractors alike were fired with a determination to supply that need as quickly as possible. But we shall not say more now of these activities, which began in the early part of 1917 and ended with the opening of navigation on May 15, 1918. The story forms so interesting an account and a subject which is so complete in itself that it is being reserved for a separate chapter.

Briefly we may review a few statements in the State Engineer's account of the year's work as told in his annual report. On the Champlain canal only two contracts remained uncompleted, the work still to be done being a small amount of excavating south of Fort Edward and in the vicinity of Schuylerville. The Erie canal was virtually completed from the Hudson river to the Cayuga and Seneca junction at Montezuma. West of that point the unfinished portions were near Clyde and Lyons, in the vicinity of Rochester and at Tonawanda. Whether the canal could be opened throughout its entire length was to be determined by the completion of the work in the vicinity of Rochester. This work consisted principally in the construction of a dam across the Genesee river, heavy excavation through and east of Genesee Valley park, the building of a guard-lock, the completion of the concrete trough across the Irondequoit valley and some excavation between that point and Fairport.

The canal route through Tonawanda had presented many interesting but most complex problems. Here the interests of the State, the municipalities and the railroads seemed to be in conflict. The objects to be attained were these: Tonawanda creek must be deepened and connection made with the Niagara river; the dam in this creek had to be removed; two railroad lines crossing the canal were to be consolidated into one line and carried over the canal on a movable bridge; a movable highway bridge must be constructed; minor alterations were to be made at another highway bridge and also another railroad bridge and eventually these two structures

must be changed so as to give unlimited headroom over the canal. The special chapter on the work of this year tells how this work, in spite of its intricacy, was carried to successful completion.

In 1917 an interesting canal celebration, unlike any other demonstration connected with Barge canal construction, was held in the city of Rome. It commemorated not a new but an old event, not the completion of some portion of the new waterway but the beginning of the original State canal. Before the days of internal improvements Rome had been the important inland center of trade and travel in the state, since here radiated the routes along the interior watercourses. It was quite in keeping with this preëminence therefore that the enterprising citizens should have seized their opportunity of having the first work on so tremendous an undertaking as a canal across the length of the state performed in the vicinity of their village. Their zeal must have been extraordinary. The first contract was dated June 27, but on July 4, 1817, combining the canal and Independence Day celebrations, the first sod was turned, accompanied by appropriate ceremonies and in the presence of State officials and other distinguished persons. The celebration in Rome on July 4, 1917, was the centenary of this event. By the united efforts of city officials and officers of the State Waterways Association it was made a memorable occasion. While it commemorated a century-old occurrence, the pervading spirit was of the present, not of the past—the ever-living spirit of improvement, the spirit which in its day attempts great achievements in order that the progress of the future may be the swifter and the surer. State Engineer Williams, one of the speakers at the centennial exercises, caught and voiced this characteristic of the celebration. "As we all know," said he, "our gathering today is in commemoration of a ceremony which took place near here one hundred years ago. But our meeting would be of little significance were it not a fact that the enterprise which that ceremony ushered in became a predominating agency in shaping the destinies of the State and the nation. And if we did not feel that the spirit of waterway improvement, born that day, still lives and exerts a mighty influence in the affairs of our commonwealth, as evidenced in the unparalleled accomplishment of the past decade, doubtless none of us would have any desire to be here today, nor have any thought of perpetuating the memory of that event a century ago."

The chief event of the celebration was a public meeting at the Family Theater. The exercises were opened by Samuel H. Beach, chairman of the local committee, who introduced as presiding

officer, Henry W. Hill, president of the State Waterways Association. Mr. Hill presented the following speakers: George Clinton of Buffalo, Governor Charles S. Whitman, State Engineer Frank M. Williams, Thaddeus C. Sweet, Speaker of the Assembly, Judge Oswald P. Backus of Rome, Edward R. Carhart of New York, former president of the New York Produce Exchange, and Wm. Pierrepont White of Utica. Of these Mr. Clinton was a grandson of DeWitt Clinton and Mr. White a grandson of Canvass White, one of the prominent engineers of the original canal.

At this meeting there were shown some interesting relics. On the stage of the theater were placed oil portraits of DeWitt Clinton, Chief Engineer Benjamin Wright, Engineers John B. Jervis, Canvass White and Nathan S. Roberts, and Judge Joshua Hathaway, president of the village of Rome in 1817, who presided at the ceremonies of beginning the original canal. There were exhibited also a model of a canal boat, brought from England by Canvass White, and two surveying instruments, also brought from England, used by Benjamin Wright in making the original surveys for the early canal.

An interesting side-light of this celebration was the locating of the point where was performed the ceremony of breaking ground for the original canal. Soon after the completion of this canal accurate surveys, to show property lines, were made by Holmes Hutchinson, one of the early engineers and later chief engineer. On the maps of this survey, preserved in the State Comptroller's office, the location of this point of first work is distinctly marked, accompanied by an explanatory note. The day before the centennial celebration the State Engineer sent one of his assistants to locate and mark this point. It is situated a little to the west of the remains of Fort Bull, an important military post during the French and Indian war of 1756. Since the outlines of the original canal are well-defined in this locality the restoration of this point was not difficult. It happened to lie at a place where the original and the enlarged Erie canals intersected. The point was marked by planting an American flag and on the morning of July 4 a company of out-of-town guests and a few of Rome's citizens went to the spot and were photographed, grouped around the flag and standing in the bed of the canal which had recently been superseded by the Barge canal.

In his report of 1916 the State Engineer had warned the Legislature that the Cayuga and Seneca canal might overrun its appropriation. At that time it had appeared that construction work might

be completed within the original funds and that the additional money would be needed simply for damage claims, but during 1917 judgments had been handed down by the courts and settlements made which exceeded the anticipated amount, and as a result funds were not available for doing the few things left undone. To insure the entire completion of this canal the State Engineer called upon the Legislature then in session, that of 1918, to appropriate a sum of \$350,000. The Legislature complied and voted the amount desired (chapter 28). The work remaining to be done consisted in completing certain cut-off walls at the Seneca Falls locks and finishing prism excavation to full dimensions at some of the railroad crossings.

In making his appeal at this time for Federal coöperation at the canal termini the State Engineer said that although the central Government felt obliged to confine its expenditures to war necessities, it would seem, in view of the millions spent by New York in building a canal which would assist materially in relieving freight congestion, that the United States should furnish the small amount of money involved and make the necessary connections between canal and Federal waters.

On May 15, 1918, the new canal was opened to navigation throughout its entire length. The interesting scenes preceding this event need not be given here since they are described, as we have said, in a chapter devoted especially to the subject. But the fact that the whole canal was in use does not mean that the new waterway was entirely completed and that nothing whatever remained to be done. It is true that the parts still to be finished did not prevent through navigation, but they were essential nevertheless to the completeness and efficiency of the canal. After opening the canal to navigation the largest piece of construction work remaining to be done was that in the Rochester harbor. By means of the expedient of a temporary dam across the Genesee the canal could cross the river and traffic could go on without interruption and at the same time the river was left free for building the spur to Rochester and completing the harbor and the rather complex adjacent construction. Another work to be done was the widening of the channel at the places where partial widths had been made to suffice for the initial opening. There were many other small pieces of work which were of such a character that they could be done without interfering with navigation. These consisted in completing the removal of the Montezuma aqueduct, building a few

bridges and power-plants, removing washed-in material, laying wash wall, cutting off projecting points and other miscellaneous work. In terminal construction also there remained much to be done.

One small feature of this first year of navigation on the whole new system is worth noticing. The Superintendent of Public Works reported that more than fifteen hundred lighted aids to navigation of various types were maintained during the year.

During 1918 the few remaining railroad crossings were so nearly completed that very little remained thereafter to be done. There were eleven of these crossings on which work was in progress during the year. One was at Schenectady, one at Brewerton, one at Lyons, two near Rochester, two at Tonawanda, one at Cayuga, one near Seneca Falls and two near Geneva.

Terminal work progressed steadily during the year. Most of the terminals had been equipped with dockwalls and areas prior to the opening of navigation in the spring and at several localities there were temporary warehouses and partial equipments of freight-handling devices, so that the terminals were ready for whatever traffic might be offered. During the year these facilities were somewhat added to and enlarged; also some new warehouses were constructed, a few rail connections were made and some freight-handling apparatus was installed.

The canal contracts let during 1918 were for small pieces of work here and there, either in completing some unfinished portion or in making an improvement which actual use of the canal had dictated. By way of completing the channel the contracts provided for removing the aqueduct at Rexford, excavating at the Brewerton railroad bridge, completing the excavation in the Federal waters at Oswego, repairing a sewer at Seneca Falls and completing several unfinished places in the Cayuga and Seneca branch. The list of improvements included channel excavation below the dams at Scotia and Rotterdam, waterproofing the concrete prism lining at Little Falls, a movable dam at Mohawk village, bank protection between the two locks near New London, improving the spillways at the two locks near Rochester, realigning the bridge on the west road between Henrietta and Rochester and building concrete guide-piers below the locks at Mechanicville and Fort Miller. There were also contracts for furnishing lanterns, buoys and lamp posts for the channel in the Seneca, Clyde and Genesee rivers and Tonawanda creek and for a bascule bridge over the upper lock at Fulton.

The list of new terminal contracts in 1918 is large. The names of two new terminals appear, Pier 5 and Long Island City, both in Greater New York, and at the latter place a contract for a warehouse also was let. Several other new warehouses, or freight-sheds, were provided for, these being located at Pier 6 at New York, where contracts for plumbing, heating and wiring were added, and at Amsterdam (a second house), Canajoharie, Little Falls (an extension), Herkimer, Utica (an extension) and Syracuse, and on each of piers Nos. 1 and 2 at Erie basin, Buffalo. Paving was contracted for at Long Island City, Schenectady, Amsterdam, Fonda, Frankfort, Utica, Oswego (lake terminal), and Erie basin, Buffalo. Railroad or crane tracks were to be added at Schenectady, Utica, Oswego (lake terminal), and Erie basin, Buffalo, both piers Nos. 1 and 2. There were also contracts for capstan and trolley hoist machinery at Pier 6, derricks at Syracuse, and fourteen two-ton tractor cranes, which were delivered at Pier 6 (two cranes), Long Island City, Troy, Schenectady, Amsterdam, Utica, Oswego (lake terminal), Syracuse, Lyons, Lockport (lower terminal), Tonawanda and Erie basin, Buffalo (two cranes). In addition there were contracts for razing buildings at the site of the upper Troy terminal, for a fence at Amsterdam and for shore protection at Erie basin, Buffalo.

At the close of the year State Engineer Williams called the attention of the Legislature to the fact that it must squarely face the situation that canal terminal construction could not be carried on to satisfactory results, nor even as originally contemplated, unless further appropriations were made. The authorizing law had specified rather explicitly what was to be done at each locality, but because of increased costs and other adverse conditions these directions could not be followed to the full without exceeding the funds then available. At several places, Troy and Rochester being conspicuous examples, the original appropriation was entirely inadequate to provide for anything like a satisfactory development. Moreover some localities on the canal, which had not been named or provided for by the terminal law, were asking for canal terminal facilities. Mr. Williams recommended therefore that additional appropriations be made.

During 1919 the little work that was done on canal construction consisted in additional bridges to span the channel, further protection to banks and channel, widening the approach in the Rochester harbor and other miscellaneous work. In terminal construction

there was considerable activity, the larger part of it being in New York city, although more or less was done at other localities. The installation of freight-handling machinery and electrical equipment held a prominent place in the attention of the canal builders.

On the afternoon of October 14, 1919, the canal terminal at Pier 6, East river, New York city, was formally turned over to the Superintendent of Public Works by the State Engineer. Appropriate exercises had been arranged to mark in a fitting manner this the occasion of placing at the disposal of commerce the first well-equipped warehouse of modern type to be owned and operated by the State. There was present in the new terminal shed a large assemblage. Prominent among those gathered were Governor Smith, the members of the Canal Board and other State officers, Dock Commissioner Murray Hulbert and other officials of New York city and also officials of other municipalities of the state, former State officers, who had had to do with the inception of canal and terminal projects, representatives of commercial organizations of the state and a large number of prominent citizens.

The ceremonies were opened by State Engineer Williams, who formally notified Superintendent Walsh of the completion of all construction work on the terminal and duly transferred the structures to him for maintenance and operation. In a brief speech Mr. Walsh accepted the responsibility and then turned the rest of the ceremonies over to Lewis Nixon of New York city, who, it will be remembered, had been prominent in early canal and terminal agitation and who had been Superintendent of Public Works for a short time. After making an address Mr. Nixon called upon Governor Smith, also some of the members of the Canal Board and others.

At the shore end of the freight-shed at Pier 6 there had been erected a building in which were located not only the offices connected with the terminal itself but also suitable quarters for the New York city offices of the departments of the State Engineer and the Superintendent of Public Works. On the day following the ceremony of opening the terminal the Canal Board held a meeting in one of these rooms. This was the first time that the Board had ever held a meeting in New York city in a building owned by the State itself.

In 1919 a hundred lights were added to the fifteen hundred already in use as navigation aids. The State was trying to encourage the boatmen to run at night and the attempt was gradually meeting with some success. The importance to both shipper and carrier of



Terminal at Piers 5 and 6, East river, New York city, the equal or superior of any pier in New York harbor in equipment for handling freight. Some of the mechanical devices are seen in the view — two 1½-ton straight-line cranes on the farther side of the shed roof, two 3-ton semiportal revolving cranes on the nearer side, and a portable revolving crane on the pier beside the shed. Pier 5, shown in small part at the right, has not been equipped with a shed.



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operating the whole twenty-four hours of the day was apparent. It was during this year that a fleet of the old type of canal boats made a new record for passage from seaboard to Lake Erie — four and two-thirds days. The equipment of lights, buoys and other markers was now fairly adequate. The weakest part of the whole lighting system — the corps of light-tenders — was about to be reorganized.

Of the canal contracts let in 1919 five were for completing work in the vicinity of Rochester. These included channel excavation in both the Genesee river spur and the main line near the river; also two bridges in Genesee Valley park. In addition there were contracts for prism excavation near Fairport, for completing concrete lining at Cartersville, repairs to the lock and dam at Rotterdam, sheet-piling and concrete lining at points along the Rochester-Lockport level, rebuilding the upper end of the Lockport flight of locks, a bridge at Lyons, extending core-wall at the Seneca Falls dam, and navigation aids in Cayuga and Seneca lakes.

Among the terminal contracts awarded in 1919 were two new names — Halletts Cove and Flushing — both in Greater New York. The remaining contracts included warehouses or freight-sheds at Greenpoint, Gowanus bay, West 53d street and Flushing, all in Greater New York, and at Cohoes, Rochester and the river terminal at Oswego; also plumbing, water or heating systems in the houses at Long Island City, Troy and Erie basin, Buffalo, and electric installations at the latter place, at Long Island City, West 53d street and various other terminals in New York city and elsewhere. There were contracts also for dredging at three of the New York terminals, for paving at four of them, for freight-handling cranes at Pier 6, West 53d street and Greenpoint, for minor machinery at several other New York city terminals, for clearing lands and erecting structures at Rochester and for shore protection at Erie basin, Buffalo.

In his annual report for 1919 Mr. Williams again called attention to the need of additional funds to make the terminals as complete and as efficient as the canal demanded. Since the Barge canal was called upon to compete with the railroads and also the Canadian canals and since it had to overcome such obstacles as ignorance, indifference, prejudice, open opposition, sharp competition and the inertia of established commerce, it needed every help to enable it to reduce shipping costs to a minimum and no field was so fertile for reducing these costs as that of terminal expenses. Mr. Williams recommended therefore that money be appropriated for full terminal

equipment. He recommended also action to induce the Federal government to coöperate at the canal termini.

The Legislature to which this appeal was made for additional terminal moneys responded by appropriating \$750,000 for New York city terminals, \$600,000 for Buffalo and \$500,000 for Rochester. It was to this Legislature, that of 1920, that the strong pleas for grain elevators were made by Governor Smith, State Engineer Williams and Superintendent of Public Works Walsh. This want was also supplied in part. Elevators were authorized at Gowanus bay, New York city, and at Oswego, the former with a prospective appropriation of \$2,500,000 and the latter with one of \$1,000,000, but only \$550,000 and \$225,000, respectively, were set aside at that time.

In 1920 another hundred channel lights were added to the navigation aids, bringing the total to about 1,700. The buoy system, in the opinion of Superintendent Walsh, was now the most nearly perfect of its kind in the United States. Moreover at the beginning of the season a reorganized light-patrolling scheme was instituted. Instead of the former haphazard selection of men from among those living in the vicinity of the buoys to be tended, the positions were placed in the competitive civil service class and appointments were made from eligible lists established by open examinations. Formerly also it had been required that these men furnish their own craft, but now a motor boat was provided for each man, to be used solely in the performance of his duties. In addition the patrolling sections were shortened to an average length of ten miles and the lights in each section were placed under the charge of a single employee. It was his duty to visit each light under his care every day and keep it in perfect condition. During the season the new plan showed excellent results. The type of young men attracted to this service promised for the State a conscientious attention to the work and the most serious problem connected with this important branch of canal administration seemed to have been solved.

A small amount of construction work was done on the canal in 1920, but all of it was what may be termed incidental work. It consisted in building bridges, providing additional protection for banks and structures and some miscellaneous work of a character to improve the conditions of navigation. The bridges, nine in number, were located at Tonawanda, Phoenix and Schenectady, and near Rochester and Lyons. The last of the railroad bridges, the structures which had given so much trouble all through canal construction, was among the number and this last one was nearly

completed. Bank protection was needed near Rochester, Macedon and Cartersville. In addition there were a widening of the channel near Crocker's Reef, repairs to the Lockport locks and the Seneca Falls dam, the substitution of a new type of dam for one less satisfactory at Mohawk and the completion of work connected with canal construction in Genesee Valley park, near Rochester.

The spur to Rochester, about three miles long and lying in the Genesee river, was opened to navigation in 1920. The channel in the river had a width of at least one hundred feet, which would accommodate traffic till it could be widened to two hundred feet.

Considerable progress was made in terminal construction during 1920 — in extending what had not already been completed. Since the terminal project was so nearly finished at this time it seems fitting just now to review briefly what had been done at all of the terminals. To do this it is necessary simply to quote certain reports of the year. Both the State Engineer and the Superintendent of Public Works gave a summary of terminal construction in their annual reports and in addition Mr. Williams read a paper on "The Development of Barge Canal Terminals" before the State Waterways Association at its annual convention on November 11, in which he described what had been done, especially in New York city, and included in his description many details of freight-handling devices. The first quotation comes from this paper. Following it there appears an excerpt from Superintendent Walsh's report. This latter gives in tabular form the status of all terminals in the state except those situated in New York city.

"The most important terminal equipment," said Mr. Williams, "is the freight or transit shed for cargo held on the wharf in transit between barge and shore. The function of the shed is to protect freight from the elements and to prevent theft of merchandise. The general features of construction are not essentially different from those of similar structures not located on the waterfront. The sheds should be sufficiently large in area to hold the freight in transit, space should be provided so that the cargoes may be spread out to allow sorting according to consignments and, as a rule, it is wise to construct sheds without posts supporting the roof so as to have a clear, unbroken floor space to facilitate the handling of goods.

"We have built or are constructing several types of sheds. For example at Pier 6, and at Gowanus Bay, we are using steel framework with corrugated metal siding in order to obtain lightness of

construction. At Albany and Whitehall, where the buildings are on solid fill, we have erected a steel framework with reinforced concrete siding. At some of the outlying terminals we have put up temporary wooden sheds.

"Vessels in New York Harbor usually carry their own loading facilities, but barges plying the canals of the state cannot carry high masted derricks for the reason that the headroom under the bridges spanning the canal is limited. Hence for this reason unloading machinery must be installed on the wharves. There are, however, additional reasons. The primary object of installing freight handling machinery on wharves is to reduce the cost of transportation by saving in the cost of labor, by increasing the speed of loading and unloading vessels. Increasing the speed of unloading hastens the turn-around of the barge and hence increases the tonnage a given boat can carry in a given time.

"We are installing for these purposes as fast as the freight sheds are completed and funds are available, traveling cranes, derricks, portable conveyors, and are supplementing these with other means of moving freight along the wharf. These consist of hand and electric trucks, tractors and trailers, railroad connections and other devices.

"There are several kinds of wharf cranes, but the most common is the revolving type. This consists of a derrick with a boom or jib which may be raised or lowered by a motor mounted on a turn-table. This may be the low locomotive or auto type or may be the portal or gantry type in the form of a movable bridge spanning a roadway on the side of the wharf or pier. When one of the rails for such type of machine is placed on the side or top of the shed, the machine is called a 'semi-portal' crane.

"We have in use three different types of traveling crane; another type will be ready for use next spring and we have plans out for some special heavy duty bridge cranes.

"The first type is a so-called straight line crane of $1\frac{1}{2}$ tons capacity which travels on a runway supported on the roof of the freight shed and which delivers freight inside the shed. This crane has a boom hinged to a frame so that in its normal working position the inner end of the boom projects about ten feet inside the shed doorway, the outer end reaching to a point about 25 feet from the face of the dock. The machine is electrically operated and may be moved from door to door.

"The second type of crane in use is a semi-portal revolving jib crane of three-ton capacity. It is made up of a substructure shaped like an inverted 'L' called a semi-portal or half gantry. The vertical portion is supported on trucks which travel on a rail in the wharf deck. The horizontal portion travels on a rail attached to the transit shed. The boom of this machine rotates and has an effective reach of 28 feet beyond the face of the wharf. This machine is also electrically operated,

"The third type is a steam driven auto-crane, supported on four large traction wheels, carrying a vertical frame with operating machinery and steam boilers. The boom is about 30 feet long and swings through an angle of 90 degrees.

"The fourth type is known as a burtoning crane. It travels on a runway located on the roof of the warehouse in a similar manner to the conveyor crane. It has a one-ton capacity and is operated by electricity.

"Derricks of various type and designs are used at the terminals. Some are operated by electric power, others by hand. The largest derricks are of lattice steel construction and consist of masts held by two stiff legs. The booms range from 44 to 74 feet in length. These derricks have a capacity of about 12 tons. For loads of two tons and under wooden stiff leg derricks are installed.

"The conveying and tiering machine consists of a framework on wheels supporting one or more endless belts. It is especially adapted for handling freight in uniform packages and is simply a moving gang plank. This machine eliminates passing packages from hand to hand, the stevedores working at each end of the moving platform. The conveyors are capable of handling packages at the rate of a ton a minute and can transport packages as fast as they can usually be fed.

"The movements back of the water line and in the transit shed consist of sorting, delivery to trucks, drays, cars and lighters and tiering. The principal equipment for this purpose is the hand truck supplemented by electric truck and tractors. The electric tractors are about 3 feet wide and 7 feet long and travel on four rubber-tired roller bearing wheels. They are in effect small, electric locomotives and in operation each handles a train of trailers behind it. The electric truck carries a larger load, moves faster and requires less labor than the hand truck, and is more economical from many viewpoints.

"The location of the transit shed in relation to other carriers is of great importance. The object is to eliminate the use of the dray for every movement to and from the warehouse except that of local delivery. Hence, we are providing rail connections to assist in the receiving and delivery of freight at every important terminal where it is possible to obtain rail service, the function of the rail service being to connect the wharf with local railroad siding and to connect the railroad system with the waterway.

"The most highly developed terminal so far completed and thrown open to traffic is that at Pier 6, East River, New York City. This structure embodies the latest ideas on the design and equipment of a freight-handling pier available for canal traffic. In its mechanical handling equipment, particularly, it is considered in advance of any of the piers in New York harbor.

"In making studies of the development of the site at Piers 5 and 6, it was planned to work along lines that would secure the most efficient operating conditions and the most intensive use of the structure at hand. It was decided to use types of construction having a fairly long life rather than to erect structures of a cheaper type that could be quickly erected but which would have to be scrapped at a later date or require large annual maintenance charges.

"The terminal is located on property acquired by the state from the City of New York for \$191,900. Piers 5 and 6 had been set aside for canal barges since the early days of the Erie Canal, but before the present improvement a single modern barge of 1,000-ton cargo could not be handled without costly delay and confusion. In the older part of New York all piers were originally laid out in the days of sailing vessels when the turn-around of the vessel was not given the importance that it is today. The piers were then used more as runways for moving cargo than for transit storage, and with the increase in the size and cost of vessels it has been found that the older piers and slips are wholly inadequate to handle modern cargoes. The same condition applies to canal traffic on the enlarged waterway.

"Pier 6, as acquired, was only 50 feet wide and could not be widened, on account of the width of the adjacent slips, to more than 85 feet. With the width of the pier determined by compromising cargo requirements with physical conditions, the problem was to get the best layout possible under the circumstances. The freight-handling equipment had to be considered in connection with

the size of pier available. This led to the selection of jib cranes for transferring freight. These were preferred because of speed and because of special adaptability for unloading barges operating on the state canals.

"In adopting jib cranes, it was decided to use the semi-porta! type and provide an uncovered roadway on the outside of the freight house in order to keep trucking in general outside of the freight house proper and to provide areas of deposit for miscellaneous cargo as deposited by cranes on the pier deck from the hold of the barge.

"In spite of the preference for the above type of crane, it was evident that with a pier of 85 feet width, it would not be possible to use cranes of that type on both sides of the pier and still have a freight house of any considerable capacity. A decision was reached to use the jib crane and roadway on the west side of the pier and to build a freight house 50 feet wide, bringing the east side of the building fairly close to the east side of the pier. In conjunction with a well known firm manufacturing special freight-handling machinery, a type of crane was designed to meet the conditions on the east side of the pier. This special crane consists of a boom projecting over the barge and through the doors into the freight house a short distance.

"The pier shed is of steel columns and roof trusses are spaced 20 feet center to center and the clearance within the shed is 18 feet 6 inches. The length of the new pier is 563 feet and the length of the shed is 490 feet.

"In rebuilding Pier 6, the old structure was cut down to the water line and capped and replaced with vertical posts. Pile bents were extended 11 feet on the east and 24 feet on the west side giving a total width of 85 feet.

"Two semi-porta! cranes have been installed. These have 6,000 pounds capacity, a hoisting speed of 120 feet per minute and a slewing speed of one and a half revolutions per minute and a traveling speed of 150 feet per minute. The outboard reach is 28 feet. The special conveyor cranes on the opposite side of the shed have a 3,000-pound capacity, and have an outboard reach of 23 feet. One tiering machine and one portable package conveyor have been installed for moving freight back of the wharf. Office space is provided in what is known as the headhouse. The operating force uses the first floor of the headhouse and the administrative offices for New York City are on the second floor. The terminal

has been equipped with heating, plumbing, lighting and battery charging equipment and is up-to-date in every respect. The cost of the freight house and equipment and reconstructed pier was \$380,000. The total cost to the State for the entire terminal at Pier 6, including acquisition of site and dredging, was \$625,000.

"It is our plan eventually to shed and equip Pier 5, but for the present we have simply repaired the pier and installed two steam cranes.

"I shall not have time to describe the development of terminals at all of the other places in New York, but at Gowanus Bay, which is the terminal designed for the accommodation of ocean-going vessels, we have built a marginal wharf 700 feet long, dredged the harbor to 35 feet, graded 30 acres back of the bulkhead, constructed a pier 1,200 feet long and 150 feet wide, erected a temporary wooden freight shed, and awarded a contract for the building of a steel freight shed. A grain elevator, of which I shall speak later, will also be constructed at Gowanus Bay.

"Other terminals in New York City, nearing completion or well under way are located at West 53rd Street, Greenpoint, Mott Haven, Long Island City, Halletts Cove, and Flushing. There have been completed in New York City and vicinity nearly two miles of docking space and about five acres of freight sheds and accommodations.

"Along the line of the canal generally, we have constructed terminals of the marginal wharf type. The waterway being comparatively narrow, conditions have not lent themselves, as a rule, to the building of the projecting or pier type of wharf.

"At Rochester, a marginal wharf 2,000 feet long has been constructed, a temporary freight shed erected, and the terminal equipped with one steam crane, and several small derricks. The situation at Rochester is very complicated in that the Lehigh Valley Railroad occupied part of the site, and because it was necessary to maintain navigation in the old canal up to the beginning of the present year and also because of the elevation of the top of the wharf in comparison with the elevation of the adjacent streets of the city.

"It was necessary to relocate the Lehigh Valley Railroad yards, and to build a long reinforced concrete approach to the terminal. Costs had so greatly increased since the funds were originally appropriated in 1911, that we were unable to complete the development of this terminal. The last Legislature, however, provided

additional funds and we are now going ahead with the uncompleted portion and expect to award a contract to begin work on a permanent freight shed within a month or two.

"At Syracuse, the terminal is located at the head of Onondaga Lake on the old salt marshes. A channel has been dredged to connect with the Barge Canal and a temporary freight shed erected. We have had considerable difficulty in getting railroad track connections installed, but within the last month an agreement was made by which a siding has been placed along the terminal shed by the D., L. & W. Railroad.

"At Utica, the line of the Barge Canal is some distance from the site selected for the terminal and it was necessary in this case to build a lock of standard canal dimensions and excavate a channel and harbor in order to locate the terminal so that it would be within easy reach of shippers.

"At Buffalo, we are developing two state-owned terminals, one at Erie Basin and the other at Ohio Basin. Up to the close of last season we had constructed two piers at Erie Basin, paved part of the site, built a temporary wooden freight shed 200 feet long and connected it with the New York Central Railroad for industrial purposes. Since then we have finished the construction of a permanent steel freight shed on Pier No. 1, 500 feet long by 80 feet in width. The warehouse will be equipped with heating, plumbing and lighting systems, and we have recently awarded a contract for two electric semi-portal revolving jib cranes of a 3-ton capacity. The cranes have an effective reach of 28 feet beyond the face of the dockwall. There are also in use on the terminal two steam cranes, of the Byers type. The booms are 30 feet long and the machines have a capacity of two tons. The area surrounding the piers has been dredged to 20 feet, which makes it possible for lakera to dock and load or unload cargo at the terminal.

"At Ohio Basin, we have dredged the harbor to a depth of 20 feet and this will eventually be surrounded with a concrete dockwall and paved wharf. The Old Banner Milling property is so situated that it can be converted into a terminal freight shed. There was recently advertised a contract for continuing the wall around Ohio Basin but the bids received were so high that the contract could not be awarded. At the last meeting of the Canal Board I presented revised plans for this work and the contract will be

re-advertised shortly. Our funds are limited and it will only be on the basis of increased appropriations that we will be able to continue the work of developing the Buffalo Terminals.

"At Oswego there are two terminals, one known as the river terminal, and the other as the lake terminal. The lake terminal, as its name implies, is designed to accommodate lake vessels as well as barges and in this respect is similar to the terminals at Erie Basin, Buffalo, and at Gowanus Bay, Brooklyn.

"Wharves have been constructed at about forty other municipalities along the line of the canal and the equipment of these with freight houses, cranes, etc., is being furnished as needed.

"In addition to a lack of funds to carry out the development scheme for some of the present terminals, there are three respects in which the terminal program is not complete:

"*First:* No provision was made in the original act for terminals at cities along the Hudson River below Albany and outside of New York City.

"*Second:* No provision was made for coal handling equipment to be located on Seneca and Cayuga Lakes for the handling of coal from the nearby mines in Pennsylvania.

"*Third:* No provision was made for grain elevators.

"I have repeatedly urged the adoption of measures looking toward the fulfillment of all of these items, but that of the grain elevators is the only one of the remaining items which has as yet received favorable consideration at the hands of the Legislature, although it is my belief that affirmative action will sooner or later be given to the others."

Superintendent Walsh said, "At practically all points along the line of the improved canal where indications existed as to the development of traffic in sufficient amount, terminal docks have been provided.

"Below will be found a complete list of these localities with the equipment which may be found available at each. Where the name of the locality alone appears, a dock wall only has been provided.

Location	Type and size of warehouse	Freight handling machinery
Albany.....	Concrete and steel, 33 x 210	15-ton hand steel derrick, 2-ton portable steam crane.
Amsterdam.....	Timber (2), 32 x 100.....	1-ton derrick, electric.
Brewerton.		
Buffalo.....	Timber, 32 x 200; concrete and steel, 80 x 500.....	Two 2-ton portable steam cranes.
Canaoharie....	Timber, 32 x 50.....	$\frac{1}{2}$ -ton hand derrick.
Cleveland.		
Cohoes.		
Crescent.		
Fonda.....	Timber, 16 x 100.....	$\frac{1}{2}$ -ton hand derrick.
Fort Edward....	Timber, 16 x 30.....	$\frac{1}{2}$ -ton hand derrick.
Fort Plain.....	Timber, 32 x 100.....	$\frac{1}{2}$ -ton hand derrick.
Frankfort.....	Timber, 16 x 60.....	$\frac{1}{2}$ -ton hand derrick.
Fulton.....	Timber, 20 x 50.....	$\frac{1}{2}$ -ton hand derrick.
Herkimer.....	Timber (2), 16 x 100 and 20 x 33.....	$\frac{1}{2}$ -ton hand derrick.
Holley.....	Timber, 16 x 30.....	$\frac{1}{2}$ -ton hand derrick.
Ilion.....	Timber, 16 x 60.....	$\frac{1}{2}$ -ton hand derrick.
Little Falls....	Timber, 32 x 150.....	15-ton electric steel derrick, 2-ton portable steam crane, $\frac{1}{2}$ -ton hand derrick.
Lockport (upper)	Timber, 32 x 100.....	$\frac{1}{2}$ -ton hand derrick.
Lockport (lower)	Timber, 32 x 100.....	$\frac{1}{2}$ -ton hand derrick, 15-ton hand derrick, 2-ton portable steam crane.
Lyons.....	Timber, 32 x 50.	
Mechanicville...	Timber, 16 x 30.....	$\frac{1}{2}$ -ton hand derrick.
Medina.....	Timber, 24 x 70.....	$\frac{1}{2}$ -ton hand derrick.
Oswego (lake)...		$\frac{1}{2}$ -ton portable steam crane.
Oswego (river)..	Timber, 32 x 50.	
Plattsburg.		
Port Henry.....	Timber, 16 x 30.	
Rochester.....	Timber, 32 x 200.....	2-ton portable steam crane, 8-ton fixed steam derrick.
Rome.....	Timber, 32 x 200.....	15-ton electric steel derrick, $\frac{1}{2}$ -ton hand derrick, $\frac{1}{2}$ -ton conveyor.
Rouses Point.		
Schenectady....	Timber, 16 x 100.....	$\frac{1}{2}$ -ton hand derrick, $\frac{1}{2}$ -ton portable electric conveyor, 2 2-ton portable steam cranes.
Schuylerville.*		
Spencerport....	Timber, 16 x 30.....	$\frac{1}{2}$ -ton hand derrick.
St. Johnsville.		
Syracuse.....	Timber, 32 x 200.....	Four 1-ton electric derricks, 2 2-ton portable steam cranes.
Thomson.....		One $\frac{1}{2}$ -ton electric package freight conveyor.
N. Tonawanda..	Timber, 24 x 100.....	15-ton hand steel derrick.
Tonawanda.....	Timber, 32 x 80.....	2-ton portable steam crane.
Troy (lower)....	Timber (2), 16 x 50, 32 x 100	Two $\frac{1}{2}$ -ton hand derricks, 2 2-ton steam cranes.
Utica.....	Timber, 32 x 200.....	Two $\frac{1}{2}$ -ton hand derricks.
Watford.....		One $\frac{1}{2}$ -ton hand derrick.
Watkins.		
Weedsport.....	Timber, 16 x 30.	
Whitehall.....	Concrete and steel, 33 x 114.	15-ton hand steel derrick, 2-ton portable steel crane.

* The terminal at Schuylerville is located on a branch of the unimproved Champlain canal and is available only for the use of craft of the ordinary canal boat type.

" Railroad connections will be found at the following terminals :

" At Erie Basin, Buffalo, with the New York Central Railroad Company ;

" At Rochester, with the Lehigh Valley Railroad Company ;

" At Syracuse, with the Delaware, Lackawanna & Western R. Co. ;

" At Schenectady, with the Delaware & Hudson Railroad Company ;

" At Troy, with the New York Central R. R. Co., and Boston & Maine R. R. Co. ;

" At Albany, with the Delaware & Hudson Railroad Company ; and

" At Oswego, with the Delaware, Lackawanna & Western Railroad Company."

Only two Barge canal contracts were awarded during 1920. One was for a dam across the old canal at Rochester and the other was for widening the channel between Crocker's Reef and Fort Edward. But several pieces of terminal work were put under contract. Among them were freight-houses at Gowanus bay and Mott Haven, both in New York, and at Rochester ; also plumbing and a water-supply system and certain electrical work at Greenpoint, and paving and a heating system at West 53d street, both in New York city. Besides these there were contracts for storage yards and for freight-handling machinery at Erie basin, Buffalo, for a dockwall at Ohio basin, Buffalo, for completing certain Rochester terminal work, for protecting breakwaters at the Cleveland terminal, for completing the Rouses Point terminal and for foundations for the grain elevators at Gowanus bay and Oswego.

In 1921 a small amount of canal work was in progress. At Tonawanda the bridge carrying the main street over the canal was completed and thrown open to traffic. At Rochester the work in Genesee Valley park was finished and the deep cut to the east was protected with heavy wash wall. A bridge across the short level in this vicinity was raised to overcome a difficulty caused by surges due to lockages on so short a level. A concrete spillway was built in the Oswego river below Fulton to take the place of a dike washed away during a flood because the river channel had been too narrowly constricted by a privately-owned raceway. Efforts were continued in trying to stop a leak around the end of the Seneca Falls dam. This leak had been very troublesome during most of the time since the dam was completed. Early in 1921 the water was drawn and the bank was examined for a considerable distance. It

appeared that there were a number of seams in the rock where water entered. The whole bank was blanketed with material obtained near by. The leak diminished but was not entirely stopped.

In terminal construction there was considerable activity during 1921. One additional appropriation was made by the Legislature—a fund of \$490,000 for continuing work at Rochester. The list of places where work was in progress includes Erie and Ohio basins at Buffalo, Rochester, Cleveland, Cohoes, Troy, Rouses Point and the following terminals in New York city: West 53d street, Mott Haven, Flushing, Hallets Cove, Greenpoint and Gowanus bay.

Plans had been nearly perfected during 1920 for grain elevators at Gowanus bay and Oswego. The Legislature of 1921 appropriated \$1,950,000 for the Gowanus bay structure, this being the remainder of the sum set as the cost by the authorizing law, but for the Oswego elevator there was no money forthcoming. At Oswego therefore nothing beyond building the foundations could be done, but at Gowanus bay the house and bins were begun after the foundations were finished and were so nearly completed by the end of the year that State Engineer Williams could report to the Legislature that, barring unforeseen hindrances, the elevator would be ready for use early in the following summer.

In his annual report for 1921 the State Engineer again asked for Federal coöperation at the canal termini, but by this time the appeal had changed its form somewhat. At Tonawanda large boats found it difficult to pass from the Niagara river into the canal and it was desired that the Government should deepen and straighten the channel. At Oswego the State had excavated a twelve-foot channel from the end of the canal to deep water in the lake, but a channel deep enough to allow lake vessels to reach the terminal constructed by the State on the lake shore was needed and it was considered that the Government should excavate this channel. At Whitehall the Federal authorities had done some work in deepening and straightening the channel at the upper end of Lake Champlain, but not enough had yet been done. At Waterford an outlet of Barge canal dimensions had been provided, but a channel of sufficient size was desirable to permit large vessels to reach Troy or Albany for the transfer of canal and ocean cargoes, and this work came under United States jurisdiction.

During 1921 night travel on the canal increased in large measure. Four hundred lights were added to the navigation aids. In the earlier years it had not been deemed necessary to light more than

the river channels, but now the land lines also were supplied with markers, in order to remove all hindrances to navigation by night. The good effect of this policy was apparent. The year showed a marked improvement in the running time of navigators. Greater familiarity with the canal as well as better facilities helped toward this result, but a general increase in speed was noticeable. Fleets were making the trip from Buffalo to Troy in less than five days and the round trip from Lake Erie to New York and return in fourteen days.

The interest which Governor Miller showed in canal affairs was unusual for a chief executive of the State. During the summer of 1921 he took a trip over the canals and spent sufficient time in doing this to become familiar with all the essential details. In the party were the Governor, members of the Board of Estimate and Control, State Engineer Williams, Superintendent of Public Works Cadle and other State officials. The inspection began with the terminals at New York city and extended to Buffalo. The speeches which Governor Miller has made on canal matters, especially in opposition to the St. Lawrence ship canal project, show that he has a clear and broad understanding of the whole situation, doubtless gleaned in part through his personal inspection of the canal system. These utterances have been a valuable asset both for gaining friends and users for the canal and for defeating the rival project. Also the publicity given the Governor's trip had a salutary effect on the people of the communities visited — in bringing the importance of the waterway pointedly to their attention.

The Barge canal contracts let in 1921 included one for doing some excavating and filling at Seneca Falls, one for a concrete spillway below the lower lock at Fulton, one for raising a bridge near Rochester and one for removing material from the canal prism near Holley. The terminal contracts awarded during the year covered work chiefly at New York city and Rochester. At Rochester there was provision for a permanent freight-house, with contracts for heating and plumbing, and also for a frame structure, designated a temporary freight-house, and a contract for an approach to the terminal. At New York there were contracts for heating, plumbing, water-supply, certain electrical equipment and two 3-ton jib cranes at Gowanus bay and one 3-ton burtoning crane at Mott Haven. The largest terminal contract of the year was for the grain elevator at Gowanus. Aside from New York and Rochester the only new contract was for a house and gravel surfacing at the terminal at Brockport.

In this account of canal and terminal construction the record has been carried beyond the time of virtual completion of the canal project. Terminals of course are adjuncts which may be annexed to a waterway singly or at any time without greatly affecting the canal at large, and since the terminals for the Barge canal were begun much later than the channel and moreover certain terminal features have been added but recently, their construction is being protracted beyond the canal construction period. The whole length of the canal was open for traffic on May 15, 1918. Not every last thing, however, relating to even the channel itself was completed at that time, but there was nothing which would prevent full and free navigation. For a year or so afterward the uncompleted work was being finished and since then a few improvements and certain incidental work have been in progress, their purpose being to furnish that which experience has dictated as adding to navigation facilities.

CHAPTER XI

LATER POLICIES

Power Development of Canal Waters—Charting Canal Waters—Blue Line Surveys—Sale of Abandoned Canal Lands—Sale of Appropriated but Unnecessary Lands—Sale and Use of Excavated Materials—Rome-Mohawk Section—Cemetery Lands—Advisory Board Abolished—Toll Bridges—Retention of Old Canal near Waterford; also near Schuylerville—Maintenance Equipment—Reorganization of Operating Forces—Prize Lock—Maintenance of Rochester-Lockport Water Level—Protective Laws—State Towing—Faithful Performance Bonds—Contracts under War Conditions—Terminal and Navigation Rules—Attempted Federal Jurisdiction—Reorganization of Engineer's Department—Terminal Organization—Terminal Charges—Amendments to Terminal Law—Wharfage Fees Remitted—"Finish the Job."

AT THE beginning of Barge canal construction there were many questions to be decided besides those dealing with the proper design of channel and structures and the multitude of similar matters of a more or less technical character. In our study of the canal these other topics, which are concerned with policies, methods and the like, are treated apart from events which have had to do more particularly with the work of actual construction. While the larger questions of policy and procedure necessarily had to be decided early in canal construction, there have been numerous matters of similar nature throughout the whole period of building the canal. These later subjects make up the present chapter and of necessity they are not very closely connected.

Of the later policies the first in point of time to be considered by canal officials was that of developing and disposing of power which might be derived from surplus canal waters. As a matter of fact this problem received attention almost as soon as construction began, but its solution is an event of very recent date, if indeed it can be said to have been fully and finally solved.

As early as 1905 State Engineer Van Alstyne called the attention of the Legislature to the possibility of developing power at the many dams which would be built in canal construction. In the past the State had built dams for its canals and at these dams water-power worth millions of dollars in the aggregate had been generated, but in nearly every instance it had been private individuals

or corporations that had acquired possession of the power rights and had used them without making any adequate return to the State. It was to prevent such an outcome with respect to potential Barge canal water-power that the State Engineer made his appeal to the Legislature, counseling a careful guarding of the State's interests.

Through all of the years from this first recommendation until 1921, when a State water-power policy was adopted, this question of utilizing surplus waters has been most prolific of thought and discussion. In nearly every annual report the State Engineer has given it lengthy consideration, while the Superintendent of Public Works has discussed it in many of his reports. Not only these officials but others have grappled with the problem, or rather with the larger problem of which the canal question is simply a part. This larger problem—the whole broad subject of utilizing the State's available water-power in general—was under consideration and many persons were trying to evolve a policy which would safeguard the State's interests and at the same time would be fair to power companies and also present opportunities sufficiently attractive for the companies to accept. Furthermore, water-power utilization is in turn only a part of the still larger problem of conserving all natural sources of energy. The days of canal construction have been also the days when the theory of conservation of natural resources has found ready acceptance and general recognition among us. Since, therefore, such far-reaching and all-important questions were more or less at stake in the proper solution of the canal water-power problem, it is scarcely to be wondered at that progress has been slow. In 1907 the Legislature provided by chapter 494, which became section 16 of the Barge canal law, that canal waters should not be leased, sold or otherwise disposed of until the canal should be completed nor thereafter until authorized by a statute which should specify conditions and restrictions to govern such lease or sale.

In 1909 another amendment to the Barge canal act (chapter 273) empowered the State Engineer to take possession of lands, structures and waters "for the utilization and full control by the State of the waters impounded, created and to be discharged as the result of the construction of any dam, mole, reservoir or other structure as part of the improved canal system." This amendment was evidently in response to a recommendation by Superintendent of Public Works Stevens, its purpose being to provide for the acquisi-

tion of whatever was essential to the complete control by the State of its canal waters.

In 1909 State Engineer Williams advised action which would allow the use of about six thousand horse-power at each of two large Barge canal dams, those at Vischer Ferry and Crescent, which would go to waste for several years if not utilized till the whole canal should be completed. The cities near these dams took up this cry and for years the Capitol District, as it is called, echoed the demands for power from these sources.

In the official recommendations of recent years there is apparent a deeper appreciation of the need of solving the whole water-power problem of the State rather than the canal question alone. Thus we read in State Engineer Williams' annual report for 1917, "State officials and others who have given the subject some thought agree that a strong, definite policy should be adopted in treating the broad question of power development and flood control in the rivers and streams of the state. I am strongly of the opinion that the State should not embark in any proposition of this nature or become a party to any undertaking until the many varied and complex problems which are involved have been approached from all angles and solved in such a way as to insure the greatest ultimate benefit to both the State at large and its citizens."

But in spite of these evidences of a general realization of both the complexities of the problem and the need of a complete water-power policy, the canal officials and the public at large appear to have been impatient at delay and continued to urge the immediate use of canal waters. And their reasoning seems good. The dams were already built and the power was going to waste. As Mr. Williams pointed out, long-term leases could be so drawn that they would safeguard canal interests, allow the use of surplus waters, thus assuring additional State revenue as well as additional power for industrial purposes, and at the same time not interfere with any general water-power policy the State might thereafter adopt.

A list of Barge canal water-power possibilities, compiled by the Superintendent of Public Works and published in his 1919 annual report, shows the following conditions: At Crescent, Vischer Ferry, Rocky Rift, Caughdenoy, Cayuga, Clyde, Lock No. 1 on the Champlain canal and Crocker's Reef the State owns the whole flow of the streams, but no development has been made. At Fulton the flow is owned partly by the State and partly by outside parties and the power has been developed. At Minetto the State owns

the eastern half of the river's flow and the western half is developed. At High dam, near Oswego, the flow is owned by the State, but has been applied for by the city of Oswego; the power has not been developed here. At Rochester the flow from the canal into the Genesee river and certain rights in the river are owned by the State; the power has been developed. At Medina the flow is owned by the State, but its use interferes with navigation interests; the power is developed. At Lockport the flow is now under lease and permit to water-power users; power has been developed here. At Northumberland one-half of the river flow is owned by the State and there is a partial development at this location. At Whitehall the whole flow is owned by the State and power has been developed.

In 1921 the State adopted a definite water-power policy, largely through the efforts of Governor Miller. The new law created a Water Power Commission and gave this Commission the authority to issue licenses for the development of power at places where the State owns the power rights, the license carrying with it the privilege of using such water-power upon the payment of equitable rental. The enactment by Congress of the so-called Federal Water Power Commission bill made the speedy adoption of a State policy almost imperative and probably had considerable influence on State action at that time. The original law placed Barge canal power projects under the jurisdiction of the new Commission, but required that before any of them could be developed the Superintendent of Public Works must certify that such development could be accomplished without detriment to transportation on the canal. Applications were made to the Water Power Commission for privileges to develop certain Barge canal powers, but the Superintendent would not make the necessary certificate to allow the applicants to proceed. He took the stand that the execution of a certificate of this character would constitute a relinquishment to other agencies of that control of canal waters which is essential for carrying out the duties and obligations imposed upon the Superintendent of Public Works by the Constitution and the statutes of the State. It would be better, he held, that canal waters should run to waste than that commerce should be crippled. The experience of the past had shown that, once privileges to use canal waters had been granted, even under provisions of revocation, it was next to impossible to discontinue or restrict such use. Since the development of canal water-powers was thus blocked, the Legislature of 1922 took the control of canal power sites out of the hands of the Commission and gave it to the Superintendent of Public Works. The new act

constituted a State policy, applying to all potential power developments of canal waters. To begin the work one million dollars were appropriated for building power plants at the Crescent and Vischer Ferry dams. Under the act the Superintendent is empowered to sell any surplus electric current not needed by the canal or State structures adjacent to the canal.

The next subject to engage our attention is that of making charts of the canalized lakes and rivers which form so large a part of the Barge canal system. In 1909 State Engineer Williams told the Legislature that the time had come when provision should be made for preparing and printing such charts, since canal traffic would soon be turned into certain river channels. So radical were the changes in navigation in the new canal that it was absolutely necessary that boatmen should have charts. The Barge canal law contained no authorization for making charts and so the State Engineer recommended action on the part of the Legislature. A bill for this purpose in the 1910 Legislature failed of passage. In his report of this year Mr. Williams again referred to the subject, but recommended that attempt be made to induce the United States to undertake the work. This recommendation was heartily seconded by a similar one from the Superintendent of Public Works in his report of the same year. The Barge canal adjoins Federal waters at so many places that a uniformity in charts was deemed advisable and moreover the United States already had an organization, called the Lakes Survey, at work charting the adjacent Government waters, and it was the extension of this survey to cover navigable lakes and rivers of the State waterways that Mr. Williams was seeking. State Engineer Benschel continued this policy and in 1911 secured Federal coöperation. As a result the Government has made surveys and prepared and printed charts and offered them for sale, just as it has done with respect to Federal waters. These charts, however, include only such parts of the canal as lie in waters which are considered naturally navigable, but even at that they cover a large portion of the State waterway. But later other charts were issued by the Superintendent of Public Works. In 1915 he found it necessary to do considerable work in marking the river channels by buoys and lights and in the same year he began making charts, these showing particularly the location of each light, buoy or other marker. This work he continued until the whole extent of the canal was covered, land lines as well as river channels.

An important policy adopted in 1909 was that of making what are known as "blue line" surveys. On the maps of the original State canals the line showing the boundaries of lands acquired by the State for its canals was shown in blue ink. The custom of referring to this as the blue line is now of such long-standing that the term has come to be synonymous with canal land boundary line.

It was on the recommendation of State Engineer Williams that this blue line policy was adopted. In 1909 he suggested it. Since the State owned valuable property within these lines and the descriptions of much adjacent property depended on them and since also it would be almost impossible to retrace the lines after old canal banks and structures should be obliterated, the need of immediate action was apparent and the Legislature responded to the appeal and made an appropriation to begin the surveys.

In reporting on this work Mr. Williams said in his 1910 annual report: "In response to my suggestions you made appropriation to begin this work, and most wisely, it seems to me, for the need was very urgent. When it is realized that never, until the beginning of Barge canal operations, have State canal property lines been suitably monumented and that in many places no map since that of 1834 may be relied upon as authoritative in courts of law, the importance of the work is appreciated. When it is further realized that the State lands within these bounds have become very valuable in many localities and that much valuable adjacent property depends on these same lines for description or starting point, and that an alteration or destruction of existing canal banks and structures, before the 'blue line' should be rerun, would doubtless result in endless litigation and probable loss to the State, the necessity for continuing this work to the end will be seen."

As funds have become available from time to time these blue line surveys have progressed. They are as yet not entirely completed. After surveys have been made, maps have been prepared, and these maps have been submitted to the Canal Board for approval.

Closely connected with the subject of surveying canal property lines is that of disposing of such of the property itself as would not be needed for canal purposes after the new canal should be put in full operation. The need of proper legislation to provide for the sale of these old canal lands seems to have been brought to public attention first by Superintendent of Public Works Treman in his annual report of 1911. The State Constitution prohibits

the sale of the canals, but under the Public Lands law the disposal of lands no longer necessary for the canal was permitted and for years such lands had been disposed of, only small parcels, however, ever having been involved. But it was considered that the law as it stood did not apply to long stretches of canal, and the portions of canal which eventually would be abandoned because of new alignment were long in extent, hundreds of miles in fact.

Aside from the value of these lands and the advisability of putting them to some use, it was not wise for the State to be under the expense of maintenance or to be liable for damage suits, which were sure to come, or for the menace to health which an unused channel would probably cause.

For several years the Superintendent reiterated his recommendation and the State Engineer joined him in advocating the policy. In 1914 legislation was introduced but not passed. In 1916, however, the Public Lands law was amended (by chapter 299) and thereafter the Commissioners of the Land Office could dispose of such portions of the old canal lands as the canal officials had formally declared to be of no further use for canal purposes. Considerable amounts of these abandoned lands have already been sold. The stretches in the cities have been bought largely by the cities themselves and have brought good prices, the city of Rochester for example paying more than a million and a half dollars for what it secured. A plan has been adopted of dividing the land into parcels of such extent as best to fit the needs of prospective buyers, in order, if possible, to sell all the parcels and leave no isolated pieces in possession of the State.

There were other canal lands, however, for which legislative provision had to be made. In 1909 an amendment to the Barge canal law (by chapter 244) provided that in the event any piece of land appropriated for Barge canal purposes should be found not to be necessary for such purpose, after certain procedure it should be returned to the owner from whom it had been taken, together with a quit-claim deed. The terminal law was amended in like manner by chapter 488 of the laws of 1915.

In addition to lands the State occasionally came into possession, by reason of new canal construction, of certain materials for which it had no use. An amendment (chapter 320, Laws of 1909) to the Barge canal law permitted the Superintendent of Public Works to sell "any materials found in deposit or otherwise during the

progress of the improvement." In 1915 (by chapter 570) this amendment was added to and the Superintendent was authorized to allow any county, city, village or town to remove these materials encountered in canal excavation and use them for constructing or repairing highways without compensation to the State.

One portion of superseded canal which has given rise to considerable legislation and also to several constitutional amendments is that lying between Rome and the village of Mohawk. By provision in the terminal act this stretch was to be retained as a part of the terminal system. It was to be kept in a navigable state, but the size of its channel was not to be increased. New junction locks at either end, however, were made necessary. After these locks were built and the new canal in this vicinity was in use, it was attempted to keep open this old section of canal under the new conditions. But this attempt was unsuccessful and the reason was that sufficient water to fill it was not available. At least it was not available from the existing source of supply. The old canal level between Utica and Syracuse was a summit level, which was fed principally from the Adirondack reservoir supply, coming in at Rome, and from the reservoirs south of the canal and west of Rome. The new channel crosses the old canal at Rome, but its surface is several feet lower than that of the old waterway. Thus the sole feeder of the thirty-mile stretch of old channel between Rome and Mohawk was Oriskany creek, and the flow in this stream would not fill the canal to a navigable depth. After nearly two months of vain endeavor to fill the canal, men having been stationed continuously at the feeder gates and every device for husbanding the supply having been tried, the Superintendent of Public Works came to the conclusion that the task was physically impossible and called upon the State Engineer to study the situation and suggest a remedy. From his study the State Engineer determined that the flow which might be expected from Oriskany creek was entirely inadequate and other means must be found to supply the need. Two methods were suggested. One was for electrical pumps at Rome, water to be pumped from the new channel. This scheme was estimated to cost \$30,000 for installation and \$22,000 yearly for operation. The other method was the use of a dive culvert under the new canal at Rome, connecting the stretch of old canal in question and another portion of old canal which extends to the west on the other side of the new channel. This section of old canal to the west, now joined to the new canal

by a junction lock, is being retained for two reasons — it is needed to connect the Black River canal with the new waterway and also it brings part of the Adirondack water-supply. The probable cost of the proposed culvert was set at \$50,000.

To complicate the situation two other factors had entered into the problem. Eight lift-bridges spanned the old canal in Utica and one in Ilion. Previous to 1917 all save one of these bridges had been operated at the expense of the municipalities, but because of the wording of the terminal law, which reads, "The present Erie canal between Rome and Mohawk shall be retained at not less than its present dimensions, and all structures, locks, bridges and docks thereon shall be maintained and operated by the State for terminal purposes," the city of Utica refused longer to pay these operating expenses. To assume this burden meant an added \$5,000 of annual State expense.

The second factor was a proposed constitutional amendment which would permit the disposal of the old canal between Schuyler and Third streets, Utica, provided a sufficient flow of water should be maintained between these points to feed the portion of old canal lying to the east. In the form of a concurrent resolution this proposition had been passed by the 1917 Legislature, even before the problem of feeding the Rome-Mohawk stretch had much more than presented itself.

The Legislature of 1918 appropriated \$20,000 for the culvert under the new canal at Rome and this sum, together with \$30,000 contributed by interested industrial companies, built the structure. This Legislature also passed the proposed constitutional amendment the second time necessary for bringing it to vote before the people and in the following fall it was approved by popular vote.

Later the State Engineer and the Superintendent of Public Works submitted to the Canal Board the requisite statutory certificates declaring that the Schuyler-Third street section was no longer needed for navigation, but the Board took no action on the matter, since it appeared that the constitutional amendment merely gave to the Legislature the right to amend or repeal the section in the terminal law which provided for the retention of the canal. While that law stood in its existing form the Canal Board had no authority to abandon any of the old canal between Rome and Mohawk. The Board held public hearings, however, and at these the abandonment of the whole stretch from Rome to Mohawk was urged. This subject came before the 1920 Legislature, but instead

of an amendment to the terminal act a measure was passed (chapter 744) which authorized the city of Utica to lower or remove any or all of the three bridges in the Schuyler-Third street section and to construct a conduit in the bed of the canal between Schuyler and Third streets. The work the city did under authority of this law constituted in effect, though not in fact, an abandonment of the old canal in Utica.

The Legislature of 1920 also took action looking toward the abandonment of the whole Rome-Mohawk section of the old canal. By concurrent resolutions it provided for two constitutional amendments. One proposed to permit the sale or other disposition of the portion lying between the village of Mohawk and the Herkimer-Oneida county line, while the other would allow such sale of the entire stretch between Rome and Mohawk. The second proposition of course made the first unnecessary, but notwithstanding this fact the Legislature of 1921 approved both of these proposed amendments and at the general election of that year the people in turn gave their approval. The Legislature of 1922 duly passed a law (chapter 341) amending the terminal act by omitting the clause which retained the Rome-Mohawk section for terminal purposes. Accordingly this portion of the old canal now passes out of use along with nearly all of the waterway which formerly ran beside the Mohawk river from Cohoes to Rome.

Another type of land for which provision had to be made was the cemetery. In acquiring the lands necessary for an enterprise of such magnitude as the Barge canal, especially for its great reservoirs, covering miles of territory, here and there were included small areas which had been used as burial grounds. Often these were isolated and unused, the family burial-plots, perhaps deserted and forgotten, standing in the midst of cultivated field or broad meadow. Still each one, however small or neglected, was God's acre and as such was properly protected by law. The State could not with propriety flood such lands, whether small family plots or larger cemeteries, or sink them beneath the waters of a new lake without first removing whatever remains were there interred. An amendment (chapter 63, Laws of 1910) to the Barge canal law provided, therefore, that wherever it became necessary in canal construction to acquire and use such burial grounds the State should remove the bodies found therein to other plots, to be acquired for the purpose, and that the title to such new lands should be transferred to the persons, corporations or municipalities owning

the plots in which the remains were originally buried. If persons having a right to the disposition of bodies desired to reinter them in plots of their own choosing, they were permitted to do this, but without expense to the State.

With the coming of a different political party into State public affairs in 1911 several changes in canal administration were made. Among them was the abolition of the Advisory Board of Consulting Engineers. This Board, it will be recalled, was created by the original Barge canal act and moreover by an amendment to this act provision was made to perpetuate the Board to the end of canal construction. But the Legislature of 1911 (by chapter 736) abolished the Board and in its stead the State Engineer was authorized to employ from time to time, with the approval of the Governor, one or more consulting engineers. The reason given for this action was that canal work would be expedited and the new system would operate to the advantage of the State, because the consulting engineers would perform their duties under the direction of the State Engineer and would be available for consultation at all times. In his appointment of consulting engineers Mr. Bensel retained two members of the Advisory Board and named three new men. In the working out of this law it has happened that generally one consulting engineer has been employed for full-time service and the others have been called for special occasions of a few days duration each, being paid only for the time they have actually served.

Several laws enacted in 1913, 1914 and 1915 call for brief attention. In attempting to appropriate certain toll bridges over the Mohawk river below Vischer Ferry the State was involved in litigation which caused delay and also made necessary the construction of a temporary lock at the north end of Vischer Ferry dam, at a cost of \$163,000, in order to maintain navigation. A law passed at the extraordinary legislative session of 1913 (chapter 801) directed the Superintendent of Public Works to take possession of such toll bridges as had to be altered or rebuilt in canal construction and to acquire also the franchises connected with these bridges. If a new bridge were to be built to take the place of any of these toll bridges, it should be maintained by the State and become a free public bridge.

By another law of 1913 (chapter 243) the old canal from Waterford to lock No. 2 was to be retained as part of the canal system. Included in the retained channel was the portion of the Champlain canal from its junction with the Barge canal at Waterford



Bridge across the Mohawk river at Crescent. The canalization of the river necessitated the removal of an aqueduct which carried the old canal over the stream and also a highway bridge, both only a few feet below the new bridge. Except the Schenectady-Scotia structure, this is the longest bridge on the Barge canal, 1,135 feet. There are five spans, each having a clear span of 224 feet. The old structure was a toll bridge. The State has made this free.





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southerly to its junction with the unimproved Erie canal; also the old Erie from this junction southerly to lock No. 2, and in addition what were known as the Watervliet basin and the Watervliet and Port Schuyler side-cuts.

Provision was made for retaining the old Champlain canal between Schuylerville and Northumberland by chapter 412, Laws of 1914. The portion affected extended from a point immediately south of the Schuylerville waste-weir northerly to a connection with the Barge canal just north of the Barge canal lock at Northumberland. This stretch of old canal was intended to serve Schuylerville as a terminal, having been chosen by the citizens in lieu of the ordinary type of terminal. The guard-lock needed at the north end of this section was paid for out of the terminal fund. It will be noticed that by this choice no boats larger than those of old canal dimensions can reach Schuylerville.

When sections of new canal, especially the canalized river channels, were put in use, the Superintendent of Public Works found himself confronted with many new problems. The maintenance of the improved canals differed widely from that of the old waterways. Among the laws of 1914 was one (chapter 144) which appropriated funds for the purchase of new machinery for the work of maintenance; also one (chapter 145) which provided for building extra lock-gates to be ready in case of emergency. In the same year we find the Superintendent saying in his annual report that there were needed for maintenance four steel tugs, four sets of steel pontoons for raising sunken boats, six new repair shops, six dry docks, gantry tracks above the lower gates of all high lift locks, six sets of portable gantry tracks for handling smaller gates, hydraulic dredges for the river sections and a fund for painting bridges and other steel structures. In 1915 the Legislature furnished part of this equipment. By chapter 708 funds were supplied for some of the pontoons and cranes and for painting. The maintenance equipment, however, has not kept pace with the needs of the canal. All the recent reports of the Superintendent have contained appeals for better apparatus. The State equipment, he has said, is sadly inadequate and out of date. It has been necessary often to rent machinery from contractors and such practice is condemned as unbusiness-like and unduly expensive.

In 1915 the political complexion of the State government was again changed. To the office of Superintendent of Public Works came Gen. W. W. Wotherspoon, who brought to the department a

wide experience in army affairs. Several innovations were made at this time. One of the first things to engage Mr. Wotherspoon's attention was the personnel of the canal operating forces. It had been realized for some time that the old type of lock operator would not serve the new need. Lock-tenders they had been called and the very difference in name is significant. The old locks did not demand any very high order of mentality or mechanical ability, and as the positions had generally been treated simply as political jobs, rewards for service to the party in power, the usual lock-tender had been an unskilled man, often an old man, and his appointment was for only one navigation season. There were also other canal positions which required no more ability and much the same type of individual had filled them. The positions which called for skilled labor, however, and there were many of them, had of course been filled with a higher type of man. But in large measure canal operating forces had been organized on the basis of unskilled labor and of employment during only a little more than half the year.

The new locks and other structures, with all their intricate electrical machinery, required skilled operators. How the change was made and how it resulted is told by Gen. Wotherspoon in his annual report to the Legislature. He said:

"Already there has been brought to the attention of your honorable body by my predecessor, the necessity of placing the new locks, with their extensive operating apparatus, in the hands of men familiar with machinery and who could be relied upon to take prompt action in cases of emergency. It also has been pointed out to you that the people of the State may receive the full benefit of the new waterway only through its efficient operation; and such may be had only by some guarantee of a tenure of office to those found to be efficient and experienced. With the placing under the charge of this Department of many additional new locks for operation, the importance of securing an efficient operating force was manifest. Early in the year, therefore, the Civil Service Commission was consulted with the result that examinations were devised for the positions to be filled on the new locks and the holding of such examinations was widely advertised. The results obtained are most satisfactory. The new locks are now manned by young men, skilled in the various mechanical trades, and in addition to the safe and proper operation of the lock machinery, are able to make the repairs needed from time to time without any additional cost to the State. The change in the personnel of this branch of

the service has been much appreciated by canal users as navigation of the canal and the use of the locks has been placed on a definite and precise business basis. It is my belief that at the present time, the lock organization of this Department, man for man, is equal in ability to any similar force in the employ of any corporation or great business enterprise."

Another innovation was the prize lock. At the beginning of the 1915 navigation season a prize was offered to the crew of that lock which at the close of the season should have attained the highest excellence in the condition of the operating machinery and the appearance of the structure and grounds. The prize consisted in a small increase in salary to each man and the distinction of erecting a sign proclaiming it the prize lock, both of these privileges to be retained for only one year unless the same crew won again the next season. The plan was most successful. The machinery was kept in perfect condition and the surroundings were beautified, unsightly banks and the debris incidental to construction having disappeared. This plan has been continued and has worked out to the benefit of the State.

Upon assuming office Gen. Wotherspoon found that an unfavorable condition existed with regard to supplying the Rochester-Lockport level with sufficient water for navigation. Until the new channel should be completed and the supply could be taken from the Niagara river at Tonawanda the water had to come from Lake Erie and pass through the unimproved channel between Buffalo and Tonawanda in such quantity as to fill the enlarged prism from Tonawanda to South Greece, about seventy-three miles distant from the source of supply. To aggravate the difficulty there were factories along this stretch which depended more or less on canal water for power. While Gen. Wotherspoon appreciated the importance of manufacturing, he considered that his first duty to the State was to insure water for navigation. Accordingly he adopted a new policy; he placed the matter of maintaining the proper depth of water in this level in the hands of a single official who was answerable only to the Superintendent, and he gave strict orders that no water was to be diverted from the canal except with the knowledge and consent of the Albany office. The result was that for the first time in several years no complaints of insufficient depth were received from the boatmen.

Gen. Wotherspoon succeeded in having two important laws passed in 1915. These had been suggested by his predecessor, Superintendent Peck, just before he vacated the office. One (chapter 448)

made it a felony for any person without authority of law wilfully to inflict an injury upon any part of the canal system or to tamper in any manner with the machinery or apparatus connected with any mechanical structure. The other (chapter 491) declared it a misdemeanor for anyone without authority to remove any timber or growing things or materials from State land or to erect any building thereon. In the past the Superintendent had found himself with little authority to right certain wrongs and these statutes were intended to assist him.

The coming of the Barge canal has marked the end of the century-old custom of animal towage on the New York canals. No towing-paths even have been provided on the new waterway, except such as were used temporarily during the period of transition. In 1914 two stretches of new channel which had no towing-paths were opened to navigation. One lay in Wayne county, about twenty miles in length, and the other was a portion of the Mohawk river between Vischer Ferry and Rexford. Being thus isolated, with portions of the old canal extending from either end, it was necessary to provide some means of towing horse-drawn boats across these sections, since such craft constituted a large part of the shipping then in service. Accordingly the Legislature appropriated \$40,000 to pay for tugs to do the towing in these sections. In 1915 the Wayne county portion had been lengthened, but it was still isolated. The Mohawk river section had been extended to the Hudson river at Waterford and therefore had not the excuse of isolation in requiring State towage, but another appropriation was made that year and the practice was continued. By 1916 the Mohawk river navigation reached from the Hudson to Jacksonburg, a distance of eighty-six miles. On the Champlain and Oswego canals boatmen had adapted themselves to the new conditions and had their own facilities for towage, but on the Erie branch sixty per cent of the boats plying on the canal were horse-drawn and again the State had to furnish tugs.

Each year after 1914 and until 1921, except during 1918, when the Federal government was in full control of canal transportation, the State made provision for towing such boats as had no other means of propulsion. In effect this was the adoption of a policy, although it was done through necessity and not from free choice or with the idea that it would be permanent. This action really amounted to a canal subsidy, a thing which is acknowledged by canal advocates as unwise and also as tending to discourage the

best kind of private enterprise on the canal. But the State was confronted with the alternative of providing towage that would permit the majority of available canal craft to engage in traffic or of declining to do so, with the certainty of depriving the waterway of the larger part of its floating equipment and thus denying many shippers the advantages of canal transportation and condemning the waterway to comparative disuse. It was acknowledged of course that a sufficiency of new boats should be put on the canal and the State should not be compelled to furnish towage for the antiquated craft, but lacking this ideal only one course seemed open. The venture was not a success financially. For the first three years the towage was free and after that time the rates charged the boatmen were not sufficient to recompense the State. The cost, moreover, was large; as new sections of canal were added the amount for towage mounted higher and higher. And after all these costly endeavors to favor the owners of old boats there appears the prospect that the rate war they are planning will drive from the canal the new boats which are being operated by responsible companies and are giving such class of service as has long been the object of earnest seeking.

In 1921 the practice of State towage was discontinued. The experience of the year seemed to show that it had been maintained as long as necessary, since no marked detriment to canal traffic followed its cessation.

In 1916 at the suggestion of Superintendent of Public Works Wotherspoon a new policy was adopted with reference to the amount of security contractors should be required to furnish for the faithful and complete performance of their contracts. Originally the Barge canal law had fixed the amount as at least twenty-five per cent of the bid. By an amendment in 1909 (chapter 267) this had been reduced to ten per cent. Experience had shown that occasionally the State had lost money by this provision. It had been compelled sometimes to complete work which a defaulting contractor had failed to finish and to do this at a cost greater than the contractor's forfeited bond. The law of 1909 specified ten per cent as the minimum security and so the Superintendent appealed to the Canal Board to fix a larger sum. In response twenty per cent was set as the minimum bond for faithful performance of contracts and under certain circumstances this could be increased to fifty per cent.

The great bulk of canal construction had been completed before the United States entered the World war, but work to the value

of about six million dollars was under contract on the day when the declaration was made. Almost immediately industrial conditions began to change and it was with continually increasing difficulty that the contractors on the Barge canal were able to continue their work. It was during this first year after America's entrance into the war, it will be recalled, that such strenuous efforts were made to complete the channel throughout its entire length for an opening to commerce in the spring of 1918. To accomplish this desired end the engineers and the contractors worked most zealously and the contractors bravely did their part, although they faced the certainty of having to bear heavy financial losses. Since the contractors who had undertaken work before war was declared were not responsible for the conditions which ensued and could not well have foreseen what was to happen, it was felt quite generally that they should not be made to suffer for the benefit of the public and therefore relief measures were sought. Thus we find State Engineer Williams making an appeal to the Legislature on behalf of Barge canal contractors.

The Legislature of 1918 responded to this and other like requests and passed a law (chapter 585) which recompensed the contractors for their losses. Not only Barge canal contractors but those on other forms of public works were included in the scope of this act. We need not consider the details of the law. Its provisions were rather intricate and demanded very careful study. Our chief interest is in knowing that the State adopted this policy of relief toward the contractors carrying on its public works who were caught unawares on April 6, 1917. So far as Barge canal contracts were concerned the State Engineer found that virtually the whole responsibility for the proper administration of the law devolved upon him.

One of the provisions of the terminal law was that regulations for the management of the terminals should be prescribed by the Canal Board and enforced by the Superintendent of Public Works. Since the whole terminal project was a new venture on the part of the State, the canal officials deemed it wise to let experience dictate most of the rules. But from time to time regulations have been adopted and in his annual report for 1919 Superintendent Walsh published the seventeen terminal regulations which had been adopted up to that time.

The rules to govern general canal traffic had been published in convenient form some two years earlier. On July 1, 1917, Superintendent Wotherspoon had issued a brochure of sixty-two pages

comprising a complete set of rules and regulations for the control of navigation on the canals. It had been many years since anything like this had been published. A section of the general Canal Law directs the Superintendent of Public Works to make the rules to govern commerce on the canals, and as necessity has required, the various regulations have been adopted. With the advent of the improved canal new rules were formulated and in this year, since the whole Barge canal was about to be opened, the publication of the regulations then in force, both old and new, was very timely.

Since the Barge canal has been in operation there have been attempts on the part of Federal authorities to pass Congressional legislation inimical, in the eyes of New Yorkers, to our canals, and also a tendency to assert national jurisdiction over matters relating to navigation on the State canal system. It is interesting to observe how Superintendent of Public Works Walsh discovered and then thwarted one of these attempts. It was a proposed amendment to the Federal Act to Regulate Commerce which would have extended the control and jurisdiction of the Interstate Commerce Commission over carriers on the inland waterways, including the New York canals. Apprehensive of some such danger, Mr. Walsh had followed the progress in Congress of legislation relative to transportation and when this measure appeared he marshaled the industrial forces of the State—the commercial organizations, the merchants and the manufacturers—and led a vigorous attack in opposition. He appeared before the Committee on Foreign and Domestic Commerce at Washington on September 16, 1919, and presented a strong argument against the proposed amendment, saying that its passage would make railroad influence dominant over the canals and this would mean that the waterways would virtually lose their value. With the coöperation of the State representatives in Congress and the support of shipping interests the measure was defeated.

The attempts to assert national jurisdiction over State canal matters were apparent in 1919 and 1920. What was actually done was not so important, but it involved a far-reaching principle. United States officials were trying to enforce a requirement that steam or motor vessels engaged in carrying passengers or freight on the inland waterways of the state should be inspected and licensed by the Department of Commerce and should not be allowed to operate unless they were in charge of persons duly licensed by United States inspectors. These orders were issued in the name of the Secretary of Commerce, who evidently relied for his authority on

certain provisions of the United States Revised statutes which have to do with the construction, equipment, inspection and licensing of vessels using the navigable waters of the United States. It was held by Federal authorities that the State canals came within this classification. Under this interpretation the only State waterways left under State control would be small inland lakes which have no connection with the canals. So far as rules to govern navigation were concerned the State had its own Navigation Law, which was substantially the same as that of the National government and provided for inspecting vessels and regulating their management, operation and equipment for the safety of traffic.

In speaking of this action by the Government, Superintendent Walsh said it was directly opposed to the theory of canal construction and also to the basic law of the State in regard to its canals. Whether State or Federal regulations were enforced was immaterial — they were almost identical — but the underlying principle of control was all-important. If the authority of the National government to regulate navigation were admitted or acquiesced in by the State, then the right of the State to control its own waterway was lost and the several State canals became merely "navigable waters of the United States." Carried to its logical conclusion the principle would require that many acts of the Superintendent of Public Works should be subject to approval by Federal authorities, the right of Government engineers to pass upon State plans for construction and repairs could not be denied, direction for the management of canal structures forthcoming from Washington would be in order and in the end the State would be left with only the privilege of paying the bills. Mr. Walsh maintained that this conclusion was not far-fetched and he urged that every means at the command of the State and its representatives in Congress should be exerted to amend the United States statutes upon which the Secretary of Commerce relied in his entrance into the field of canal control, so as to except the State waterways from their provisions.

In 1919 State Engineer Williams reorganized his department so that it might continue on the basis of maintenance rather than that of construction, such as had been the practice for many years. As construction had advanced toward completion the force of engineers had gradually been reduced and now this which was in the nature of a permanent organization was being effected.

With the virtual completion of the terminal project what Superintendent of Public Works Walsh had to say in his 1920 report in

regard to operation, charges, revenue and other like terminal subjects is a matter of interest. In organizing his forces for terminal operation he had assigned to the care of the elaborate freight-handling machinery such employees from other branches of the department as had demonstrated their fitness. With these men as a nucleus, electricians and other skilled mechanics were added. The method of management was somewhat similar to that followed at other New York city terminals. Under its workings one or more officials, called harbormasters, remain constantly on duty during sixteen hours each day at each terminal. These men are vested with authority to enforce the adopted rules, they are responsible for State property, and it is their duty to serve the needs of traffic and protect the rights of all concerned. There is a chief harbormaster to whom all questions arising between the local harbormasters and the shipping public must be referred for decision. The chief harbormaster is guided by instructions from the Superintendent of Public Works. This plan applies particularly to New York city, but for other places also harbormasters have been appointed. This form of organization has proved to work well.

Navigation on the State canals, under constitutional provision, is free, but it has been held by canal officials that this provision does not prohibit a charge for the use of terminal facilities. It has been assumed that the authority given under the terminal act to prescribe rules and regulations carries the right to impose reasonable fees. At least such has been the policy established. Upon the Superintendent's recommendation the Canal Board adopted a partial schedule of charges for New York city and Buffalo terminals. Temporarily the imposition of fees at other terminals is held in abeyance, although it has been made plain that such policy is not to be permanent. The arrangements so far have seemed to be satisfactory to everybody and the fees have been paid willingly. Care has been taken not to make the charges too great, lest traffic be discouraged, but it is considered only just that the canal terminals shall become self-supporting.

The revenues from the New York city terminals had become sufficient in 1920 to assure their position not only as self-supporting institutions but also as producers of a surplus for making future improvements.

For the better management of the terminals Superintendent Walsh suggested a few amendments to the law. As the law stood the Canal Board was the governing body and the Superintendent was limited in his acts to directions given by the Board. In the opinion

of Superintendent Walsh, while this provision was wise in its application to broad matters of policy, it restricted the Superintendent so narrowly that he could not cope with exigencies as they arose or administer the terminals to the best interests of the State. Mr. Walsh recommended an amendment to correct this situation. He also recommended an amendment to allow the Superintendent to impose penalties for the violation of rules. It was necessary too that the Superintendent should have authority to remove from a terminal any vessel, sunken or afloat, which should become a hindrance to the proper use of the terminal or a menace to other craft. As a fourth recommendation he suggested that a similar provision should authorize the disposal of freight which the owner should refuse or neglect to remove or which might be unclaimed or abandoned.

In 1921 Superintendent Cadle remitted wharfage fees on boats lying at terminals and loading or unloading. He considered that every effort should be made to foster use of the canals and this was one means he employed to accomplish the desired end.

As a final policy there remains to be considered, not a policy adopted by some canal official in connection with construction or management, but a policy advocated by representatives from commercial and civic bodies throughout the state. The questions involved in this policy had been receiving much attention for some time and many conferences were held, not only to formulate a definite policy, but also to determine the nature and location of further canal improvements. The subject was thoroughly discussed at public meetings and it was decided to submit to the Legislature a proposition calling for a further issue of bonds. The slogan "Finish the job" was adopted and after a meeting held in Albany in March, 1920, a program of action was adopted which resulted in the introduction in the Senate of a bill to authorize a bond issue for a sum not to exceed \$33,000,000. The particular improvements specified in the bill included grain elevators, coal transfer terminals, Hudson river terminals, the completion of certain canal terminals and new canal terminals. The locations and the sums for the grain elevators were: Buffalo, \$1,600,000; Tonawanda, \$1,000,000; Oswego, \$1,000,000; Gowanus bay, New York, \$2,400,000. There was to be coal transfer construction at two terminals, Ithaca and Watkins, to cost \$1,250,000 at each place. Terminals were to be built at five Hudson river cities, these being Poughkeepsie, to cost \$400,000; Kingston, estimated at \$700,000; Newburgh at \$600,000; Hudson at \$300,000; and Yonkers at \$500,000.

For completing terminal construction there were to be the following sums: At Erie and Ohio basins, Buffalo, \$2,500,000; at Rochester, \$1,400,000; at Syracuse, \$650,000; at Utica, \$450,000; and at New York city, \$3,500,000. A million dollars was added for terminals at municipalities not specifically mentioned and for coal- and freight-handling devices at all terminals. These items totaled \$20,500,000. The remainder, \$12,500,000, was intended to cover obligations said already to have been incurred by the State in connection with damage claims arising from canal and terminal work performed.

Although the bill failed of passage, appropriations have since been made for some of the projects. The Gowanus elevator has been built and that at Oswego started. Sums have also been provided for continuing terminal work at New York city, Buffalo and Rochester. The State had previously made a beginning of the Hudson River terminals. All of these several projects gathered together in a single measure had the appearance of a large, new policy, but really it was only the assembling of what had been discussed and advocated separately and in part had already been adopted or soon thereafter was to be adopted as a State policy.

CHAPTER XII

OTHER DETAILS AND INCIDENTS

Pollution of Canal Waters—Attempt to Secure Crescent Power—Canal Lands for Municipal Parks—Tree-Planting on Canal Lands—Canal Lands for Industrial Use—Proposed Wider Channel, Waterford to Oswego—Bridge Dam Made Highway Bridge—Old Canal Filled at Fulton—War Time Military Protection—Schenectady-Scotia Bridge—Rexford-Aqueduct Bridge—Bridges at Phoenix, Fulton and Minetto—Elements of Efficient Canal Management—Zones of Canal Influence—Canal Visitors.

DURING the years of constructing the Barge canal there has been a multitude of interesting incidents which have been neither matters of policy nor yet affairs very intimately connected with the actual building but which have been more or less closely associated with the canal and are important enough to deserve a few brief words of notice. Of the many incidents only a few can now be reviewed. Of necessity these have but little connection one with another.

The first in order of time of those to be considered is the attempt to rid canal waters of pollution. In his report of 1907 Superintendent of Public Works Stevens discussed this subject at some length. What he said pertained largely to the old canal but a glance at his statements enables us to know what harmful practices had prevailed on the old waterway—practices which in some measure were being carried over to the new canal. For years the citizens of the cities and villages through which the canal passed had come to look upon the waterway as the legitimate place for emptying sewers or for receiving whatever noisome or waste materials they desired to be rid of. As a result, during the summer the waters were foul and in winter, when the canal was empty, it resembled a public dumping ground and an open sewer. The State could not well maintain a force for policing the whole length of the canals, and municipal authorities, both police and health officers, seemed to have fallen into the way of entirely overlooking violations of the penal code if the offenses were against the canal. The waterways accordingly had become displeasing to the senses and a menace to health. Inherently the canals were capable of being attractive. Some of the purest water in the state, from mountain streams

or woodland brooks, was used to feed them. The disrespect thus engendered for the physical appearance of the canal could but be reflected in a feeling that the waterway was of little real use. How wide-spread was this opinion we have already seen, and the communities which were the chief beneficiaries from canal traffic were largely responsible for this conception, since they by their failure to enforce the law had fostered the evil practices. Mr. Stevens had instituted a reform and was trying to instill a wholesome respect for the canals by making them less offensive to sight and less detrimental to health.

Since the Barge canal lies largely in natural streams the conditions attending the pollution of its waters differ from those of the old canal. The tendency to use it as a dumping ground is not so great but the practice of making it a receptacle for sewers and industrial wastes still goes on. The desire to exclude pollution from our canals has now been reinforced by the incentive to keep clean our principal natural streams. Moreover the old custom of draining all sewage, without chemical or other treatment, into streams is gradually giving away to the modern idea of scientific disposal plants. But this change, if left to municipalities alone, is slow and so we find State officials endeavoring to hasten the time when our streams will be purified.

In each of his four annual reports State Engineer Bensel recommended legislative action to provide remedies for existing conditions. Early in his administration he had consulted with Governor Dix and the State Health Department on the subject of sewage disposal plants for municipalities along the canals. The existing statutes were inadequate to correct improper conditions. Prior to 1903 the State Department of Health had no power whatever to enjoin or remove sewage pollution from any State waters. In 1903 an act was passed which provided a remedy against future pollution but which, unfortunately for the cause of stream purification, specifically exempted municipalities and industrial plants that were discharging sewage and waste into State waters at the time of the enactment. An act of 1910 invested the Health Department with further powers but failed in effective purpose because under its limitations it was necessary, after full investigation and report, to establish the fact that the pollution was a public nuisance or a menace to health. Mr. Bensel's recommendations were unavailing. A change so radical would involve large expense for the municipalities and accordingly opposition was too strong to permit

the passage of measures adequate completely to eradicate the stream pollution evil.

An incident of late 1909 and early 1910 is interesting, especially in the light of the recently-adopted State policy for the development of Barge canal water-powers. In November, 1909, the Cohoes Company, the power company which since 1826 has developed power from Mohawk river waters in the vicinity of Cohoes falls, petitioned the Canal Board, requesting the conveyance of certain lands, then a part of the old Erie canal, without compensation to the State therefor, and also the use of certain waters impounded by the new Crescent dam, as partial compensation to the company for damages alleged to have been caused by the construction of the Barge canal. Also a bill was introduced in the 1910 Legislature to authorize this company to use the waters impounded by Crescent dam.

The State canal officials were bitterly opposed to the proposed legislation. They considered it contrary to the broad policy the State, in their opinion, should adopt, namely, that of disposing of Barge canal water-powers under a general law, covering all cases, which should be to the benefit of all the people of the state rather than to a few individuals or corporations. Moreover, as was shown by the expert electrical engineer of the State Engineer's department, the company proposed to pay to the State annually from \$3,000 to \$7,500 for power which he estimated it could sell at a net profit of \$65,000. The opposition of the officials prevented the passage of the bill. One thing State Engineer Williams did to bring about this result was to print the documents pertaining to the affair in the *Barge Canal Bulletin* and send this publication broadcast over the state.

We should notice also a few recommendations the State Engineer made from time to time for employing Barge canal lands for useful public or industrial purposes. In 1909 State Engineer Williams suggested the advisability of using certain elevated areas that had been created by depositing material from Barge canal excavation. Where these areas were near cities and villages they could be converted into municipal parks and such use would greatly benefit the people of the localities and would not be detrimental to the canal.

Another suggestion Mr. Williams made was to plant trees on spoil-banks that were unsuited to cultivation. When he first recommended this, in 1910, he had in mind particularly the sandy stretch to the east of Oneida lake, where such trees, in addition to utilizing

waste lands and lending beauty to the landscape, would serve the very useful purpose of stabilizing the shifting sands. In suggesting this action later, in 1918, Mr. Williams advised the use of a much wider range of canal lands for tree-planting. A few pieces of land covered with material deposited from excavation had been reconveyed to former owners, but in the majority of cases it seemed wise for the State to retain possession, since the areas might be needed again, if in the course of maintenance more material should be taken from the channel. Moreover these lands were often in small parcels of irregular shape and covered as they were with three or four feet of newly-excavated material were of little value to private owners, especially for agricultural use. Originally many of these areas were rich bottom-lands that would be excellent for trees, once their roots had struck through the new material.

Another and a very important prospective use for canal lands was that of serving as sites for industrial plants. This suggestion came from State Engineer Bensel. In the course of construction low and waste areas had been filled and also arable lands had been made non-productive, and all together there were available numerous desirable sites for manufacturing and business plants. These were situated near the canal of course, where they would be in direct touch with water transportation, and generally rail connections also could be easily provided. And besides these advantages, factories on such sites, as State Engineer Williams pointed out in his subsequent advocacy of this project, would be in position to avail themselves of canal water-power, when such power should be developed. These suggestions have been followed in some measure. For example three large oil companies have located near the Syracuse terminal.

State Engineer Bensel made a recommendation to widen certain portions of the canal, which however was never carried into effect. He judged that a part of the traffic from the Welland canal would desire to utilize the Barge canal between Oswego and New York city, thus reaching the Atlantic coast by a shorter route than that through the St. Lawrence river. Barge canal locks would accommodate the boats which navigated the Welland canal, but there were approximately fifty miles of canal between Oswego and Waterford which had a bottom width of only 75 feet, not enough to allow two boats of maximum lock capacity to pass one another. Mr. Bensel called the attention of the Legislature of 1913 to this condition and recommended that it consider the question of making an additional appropriation for the purpose of increasing these narrow

portions of canal to a bottom width of 110 feet. The estimated cost of such widening was \$2,000,000.

The movable dams of bridge type have already been mentioned several times. Although the bridges were built primarily to function only as parts of the dams, they were inherently capable of serving also as highway bridges. There are eight of these movable dams in the lower Mohawk and some of them are situated where highway bridges across the river would be most acceptable to the inhabitants. At one dam, that at Rotterdam, the bridge has been converted into a highway structure. This work was done under an act (chapter 714, Laws of 1913) for the specific purpose, a special appropriation being made. In this instance the State bore the expense. Whether the State or the municipalities benefited or both together will pay for changes to others of these bridges, if they should be converted into highway structures, is a question still to be settled.

A work of considerable importance to Fulton, on the Oswego canal, was that of filling the channel of the abandoned canal within the city. This work was done under special authority of chapter 530 of the laws of 1914, which however directed that the money for it should be taken from the Barge canal fund.

A feature of our war-time experiences was the stationing of military guards at all strategic points on the Barge canal — places where by using explosives the waterway could be so damaged as to cause long interruptions in navigation as well as large financial loss. At all of the locks, dams and other important structures these details of soldiers were encamped. Visitors were not permitted at these structures and only persons who had passes duly signed by the proper officials and who had actual business to transact were allowed upon them. The canal officials took pains to make the soldiers as comfortable as possible during their rather long stay, especially at the outlying posts.

There are a few bridges over the Barge canal which for one reason or another can be regarded as only partially belonging to the canal enterprise. The largest and the most elaborate of all bridges spanning the new waterway — the one which joins Schenectady and Scotia — is of this class. Before the State got around to rebuilding the near-by old bridge the residents of Schenectady conceived the idea of putting the new structure a half mile farther west, so that the approach to the city would better suit their plans, and substituting for the somewhat modest but, to the minds of canal officials, entirely adequate bridge an imposing structure made up

of numerous concrete arches. When the subject was broached to State Engineer Williams he strongly opposed the plan. The cost would be many times that of a bridge sufficient to meet all canal needs. But the people of Schenectady and vicinity began to agitate the project. They advertised the structure as an essential part of the main east and west highway across the state, christening it the Great Western Gateway. They enlisted the support of the whole Mohawk valley and even the region beyond, and came down to Albany in such force that the Legislature was constrained to grant their request. First the State Engineer was directed to make plans and estimates. This was in 1917. Then in 1919 construction was authorized in accordance with these plans. The bridge is of concrete arch construction, having twenty-three arches. These range in span from 106 to 212 feet. The whole structure, including approaches, is about three-quarters of a mile long. The money for construction comes from three sources — special legislative appropriations, funds supplied by the city and county of Schenectady and the village of Scotia and a sum set aside from Barge canal moneys. The bridge is now nearing completion.

Another bridge, built because of Barge canal construction but not a part of it, is the one across the Mohawk river joining the village of Rexford and the hamlet of Aqueduct. Here the old canal used to cross the river on what was known as Rexford Flats aqueduct. The new structure utilizes parts of the old aqueduct, but a steel span crosses the new canal channel. Chapter 176 of the laws of 1921 authorized the work and provided the funds.

Three long new bridges over the Oswego river, built during the course of canal construction, were paid for only in part by the State. These bridges, at Phoenix, Fulton and Minetto, are all concrete arch structures. The State in each instance bore the expense of only the span across the canal, the remainder having been paid for by the towns connected by each bridge. At Fulton the canal span is an arch, like the rest of the bridge, but at Phoenix and Minetto the State spans are, respectively, a bascule and a convertible, the latter being capable of conversion into a bascule.

In the 1920 annual report of Superintendent of Public Works Walsh, presented to the Legislature just as he was retiring from office, we find a discussion worth noticing. He was giving his views with reference to the necessary elements of efficient canal management. In considering what he had to say it must be remembered that as a practical canal transportation operator of many years standing he had become keenly aware of certain defects in the

management of the State waterways and then as head of the department he had viewed the subject from a new angle and had learned the difficulties in the way of securing better operation.

Mr. Walsh began his discussion by commending the progress made in the preceding double decade. Prior to that time it had been the generally accepted doctrine that the canal system was a legitimate field for political manipulation, and as a result nearly the whole roster of employees had been changed with each change of administration. But even before the new canal had come into use a better condition had begun, and later, when the elaborate machinery of the new type of structure demanded skilled operators, a large part of the working force was selected by competitive civil service examinations and men of a much higher grade were obtained. Such action had met with general approbation and it was for the continuation and extension of this practice that Mr. Walsh was asking—the putting of canal operation and management on a business basis, entirely divorced from the domain of politics. Party lines had been obliterated in the agitation for canal improvement, said Mr. Walsh, and now that the new waterway had become an essential factor in commerce, strict business principles should be applied to its administration, some degree of permanency should be assured in the service and every employee should be made to feel that his term of employment depended solely on his attention to duty and his fitness for the work. But it might be, in Mr. Walsh's opinion, that the root of the trouble lay in the impermanency of the position of Superintendent, which in its legal status was no more definite than that of a humble bridge tender. His tenure of office was solely at the Governor's pleasure. The provisions governing the office harked back to the time when the canals were regarded as the battlefield of politics, when campaigns were won and lost on the success or failure of the canal administration. But those days had passed. The State's waterways were, gradually but surely coming to be recognized as a purely business institution, demanding the eradication of all elements except those tending to commercial success.

Aside from the all-important matter of transportation, other vast interests were intrusted to the Superintendent of Public Works; millions of the State's moneys were dispensed by him annually; questions of enormous importance were presented to him for decision almost daily. The efficient conduct of the affairs of the department demanded the services of a broad-minded executive of wide experience and also a continuance in office for a specific term



Taintor gate section of a dam in the Hudson river, near southern end of the Champlain canal. Each of the six gates has a clear width of 50 feet. Top of gate, when lowered, is 17 feet above the sill. Remainder of dam is a fixed structure. At its farther end is located a lock.

of reasonable duration. Since gubernatorial elections take place biennially, the Superintendent's term might be limited to two years. This had often happened and occasionally the time had been less than two years. Whenever a change should occur in the office of chief executive of the State, whether in the same political party or another or even, it might be, in the midst of a term, the Superintendent must be prepared to vacate his place in favor of the new Governor's appointee. If a Superintendent's services were limited to two years, only a small portion of that time could be devoted to the execution of policies which in his judgment seemed best for the State. More than half of the first year would have elapsed before he could acquaint himself with the vast property under his charge, the important interests he must guard and the facts as to the actual working out of the policies of his predecessor. After his own plans had been formulated, the effecting of any important changes must of necessity be gradual and slow and the result was that the navigation season of the second year would be well under way before the newly-adopted policies should be even in operation.

This situation, to Mr. Walsh's mind, was impossible. His remedy was the fixing of a definite term of office, at least five years, with the incumbent, like other State officers, subject to removal before the end of his term only upon stated charges and after a public hearing. Moreover, as far as possible the office should be removed from politics. To accomplish this latter result Mr. Walsh recommended an innovation in State affairs—nothing less than legislation which in effect would vest the nomination for Superintendent of Public Works in the recognized business agencies of the state. While this principle as a State policy might be considered as without precedent, really it had already been applied, not only in the case of the canal itself but in other State matters as well.

During the course of canal construction one particular study was made which deserves brief notice. It is a study which throws much light on the potential influence of the canal on the transportation problems of the whole state. The object of the study was to learn what proportions of the state's population were in either close or remote touch with the canal. The various branches of the canal system penetrate to many parts of the state and in the study under discussion this system was considered as consisting of all the State waterways of Barge canal dimensions. Although Lakes Erie and Ontario and the St. Lawrence river might with propriety have been regarded as parts of the waterway system, they were not so considered in this particular study. If these bodies of water

had been included, the showing in favor of the canal would of course have been still better. From the study it appears that 73½ per cent of the population of the whole state is within two miles of the waterway system. In like manner it is seen that 77 per cent of the population is within five miles, 82 per cent within ten miles and 87 per cent within twenty miles. Looking at the facts from a different angle it appears that 46 per cent of the total area of the state is within the twenty-mile limit. Considering two other distances from the waterways, fifty and seventy miles, the possibilities of a combined canal and automobile traffic become apparent. These are the respective distances which motor trucks of 3½ and 2 tons capacity can cover in a day's run, going and returning. The territory within fifty miles is 71 per cent of the area of the whole state, while that within seventy miles is 88 per cent of this total area. A productive field for motor truck operation in connection with the enlarged canals was thus revealed. Since, New York's population is approximately one-tenth that of the whole country, we see that about seven per cent of the people of the United States are within a half hour's walk of the New York waterway system. Translated into numbers this percentage represents about seven million individuals. It is apparent then what it means to the State and also to the country at large that the products of these seven million people and the supplies they need may have available the means of cheap water transportation, especially after the traffic shall have been developed to the full extent of which the new canals are capable.

Another interesting feature connected with the Barge canal is the visitors it has attracted. The new waterway has been the Mecca, of many pilgrimages. Of course it is not possible, even if it were desirable, to enumerate all of these, since no record has been kept of the great majority of them, but a few notable examples may be mentioned. Probably the largest single company to visit the canal was composed of delegates to the International Navigation Congress. This Congress convened in Philadelphia, Pa., in May, 1912. Delegates from all over the world were in attendance, some forty countries being represented. After the convention many of the visitors joined an excursion which had as one of its principal objectives the inspection of the Barge canal throughout its entire length across the state. This party traveled by special train and was large enough to require twelve cars for its accommodation. Two days, June 7 and 8, were spent in the trip from Albany to Buffalo, several rather long stops being made on the way to allow

close inspection of canal structures. Thus the party had a chance to walk over the land line at Waterford, to visit the movable dam at Fort Plain and the lock of 40½ feet lift at Little Falls, to go over the interesting work of canal construction and railroad relocation at Rome or to take automobile and visit the Delta dam, and to get a close view of the tandem locks and other structures at Lockport. Other parts of the canal, of course, could be seen from the car windows throughout most of the trip. Dr. Elmer L. Corthell, member of the Advisory Board of Consulting Engineers during the early stages of Barge canal construction, was much interested in the affairs of the Navigation Congress and he was largely responsible for arranging the excursion over the canal. Many of the delegates were engineers and were especially interested in so remarkable an engineering project as the new canal. Four or five engineers from the State Engineer's department accompanied the party.

Later in the same year another party, composed largely of foreigners and traveling by special train, visited the Barge canal, but in this case the inspection of the canal was but one of several interests. The trip made by this company was known as "The Transcontinental Excursion of 1912 of the American Geographical Society of New York," and was in celebration of the sixtieth anniversary of the Society and of the completion and occupancy of its new building, situated at Broadway and 156th street. The excursion started from New York on August 22 and after traversing the continent along a northern route returned by a southern route and reached New York on October 17, disbanding after a closing dinner at the Waldorf the next evening. Some of Europe's most distinguished scientists and scholars were in the company and everywhere along the route they were welcomed by citizens and organizations and heralded by the press in such manner as became their high standing. The party consisted of forty-three foreign members, from thirteen countries of Europe, and about a dozen permanent American members, but the director of the excursion, Professor William M. Davis of Harvard University, had arranged for many temporary members to be with the party for one, two or three days at a time in regions where they could serve as guides and helpers by reason of their own studies or their familiarity with certain local conditions. Increased by these temporary members the American contingent numbered ninety. Among the temporary members was a representative from the State Engineer's department, who was with the party from Albany to Buffalo on August

22 to 24 and also at the closing dinner at New York. At the request of the director of the excursion this representative was designated by the State Engineer and it was his task to impart to the visitors information concerning the Barge canal. It fell to the lot of the writer to be this canal representative and he observed that the members of the party, especially the foreign members, showed much interest in the new waterway, more in fact than was manifested by the engineers who earlier in the year had visited the canal with the excursion of the Navigation Congress.

In the summer of 1913 an inspection of the canal was made under the auspices of the Buffalo Chamber of Commerce. This trip extended from Buffalo to Albany and consumed three days. It was conducted personally by State Engineer Bensel and his Deputy and Division Engineers, he having attended to making arrangements for the excursion after the men from Buffalo had expressed a desire to take such a trip. The Buffalo Chamber of Commerce was the first commercial organization in the state to undertake anything of this kind. Its purpose was to afford its members opportunity to acquire first-hand information in regard to the canal and the progress of its building. The utter lack of knowledge concerning the canal on the part of chambers of commerce, boards of trade, cities, villages and the people in general throughout the entire state, and even a well-defined apathy in many places were appalling to those members of the Buffalo organization who had the welfare of the canal at heart. They determined, therefore, to make such a condition impossible in their own body and at the same time to set an example for other organizations.

The engineers who have visited the canal singly or in small groups are numerous. They have come from all parts of the world, often being sent by their governments to make a careful study of the whole waterway or some special type of construction. Some of these engineers have been about to design canals for other localities. Of this class was a company of men who had in charge the Lake Erie and Ohio River canal, a project to join the Ohio river at Pittsburgh with Lake Erie. In this instance members of the Ohio and Pennsylvania commission, as well as the engineers, visited the Barge canal. So too the Federal engineers who were to design the prospective Lake Erie and Lake Michigan canal, joining the heads of Lakes Erie and Michigan, and certain of the intracoastal canals along the Atlantic shore, as well as other national projects, have been interested visitors to the New York waterway. These engineers have always been shown every possible courtesy

and sometimes the State Engineer has assigned a member of his corps to accompany them on their trips.

The delegates to one of the annual meetings of the Atlantic Deeper Waterways Association, convening in New York city, were taken on excursion up the Hudson, in order that they might appreciate the importance of the Deeper Hudson project, and then the trip was continued to include the spectacular land line section of the Barge canal between the Hudson and Mohawk rivers in the vicinity of Waterford.

The visit of chief importance perhaps, as far as its influence is concerned, was that of the fall of 1921, when a company composed of about forty members of Congress, representing the western, southern and southwestern states, and manufacturers and business men of the Great Lakes territory, together with a goodly number of New Yorkers, were taken in boats up the Hudson and through the new canal under the auspices of certain chambers of commerce and public spirited men of the state. Inciting this excursion was a desire to combat what New Yorkers consider is the pernicious agitation for the St. Lawrence ship canal. The attempt appeared to be successful. The members of Congress acknowledged that their former ideas of the inadequacy of the Barge canal were entirely erroneous and expressed their determination to oppose the St. Lawrence scheme. Several members of the Public Works department accompanied this excursion.

CHAPTER XIII

THE COMMISSION ON OPERATION

Commission Created—Its Duties—Its Personnel—Its Work—Its Recommendations—Review of Recommendations: Traffic Organisation: Co-operative Rail and Water Relationships: Charting Canal Waters: Distribution of Canal Cargoes by Surface Railways—Mr. Bense's Dissent—Its Details.

THESE is a paragraph in the report of the Committee on Canals, the body that definitely formulated the Barge canal policy, which we did not notice in passing but which is pertinent to the subject now in hand. "As stated in the beginning of this report," says the committee, "in our judgment the efficiency of the canals depends quite as much upon the way the business is handled on them as upon their physical size, and we advise against the expenditure of any more money for their enlargement unless it shall be accompanied with measures which will lead to the adoption of more modern methods in conducting the business of water transportation across the state. The policy of the State hitherto has been to discourage the adoption of modern business methods and to foster the handling of the traffic by canal boatmen owning each a single boat, or small companies owning a few boats. This prevents the State from taking advantage of those improvements in business management which have brought about such enormous economies in other lines. Canal legislation has been largely in the interest of the comparatively small number of canal boatmen, but it has resulted in failure so far as they are concerned, for experience has shown that they are unable to cope with the methods employed through corporate action."

Some of the recommendations made by the Committee on Canals for adopting modern methods in conducting the business of water transportation were carried into effect. Aside from the repeal of the statute limiting transportation companies to a capital of fifty thousand dollars, these changes, however, had to do largely with the period of canal construction. The recommendations of the Terminal Commission in their turn resulted in the State again advancing by seven-league strides, but neither of these commissions had much more than hinted at the subject of canal administration

and management. As the time for opening considerable portions of the new canal approached this became a live topic and a commission for its special consideration was created. The immediate cause back of the creation of this commission was a recommendation by Superintendent of Public Works Treman in his annual report to the Legislature of 1912.

The specific objects of investigation assigned by law to this commission, as paraphrased in its report, were the following: Rules and regulations for operating the Barge canal; methods to be applied in the matter of maintenance; principles to be applied to the end that commerce upon the canals may be encouraged, fostered and protected; the type or style of craft best suited to navigation; rules and regulations governing the operation of canal terminals; statutory changes necessary or desirable to a proper, efficient and economical management of the enlarged canal; also any and all other subjects and matters, the study of which may be expected to contribute to a wise and efficient administration of the State's waterways system, to the end that the new and enlarged waterways may fulfill to the greatest measure possible the purposes had in mind when their construction was authorized.

The creating act, which became a law February 28, 1912, (chapter 9) called this body a Commission on Barge Canal Operation and designated as members the two who then held the offices of State Engineer and Superintendent of Public Works and three others, to be appointed by the Governor from among persons who had had executive experience in the administration of the New York State canals. After the three appointees were named by the Governor the personnel of the commission was John A. Benschel, State Engineer, Duncan W. Peck, Superintendent of Public Works, Charles E. Treman, John N. Partridge and Winslow M. Mead. Mr. Treman and Mr. Partridge had each filled the office of Superintendent of Public Works, Mr. Treman in 1911 and 1912 and Mr. Partridge from 1899 to 1901, and Mr. Mead had but recently retired from the office of Deputy Superintendent of Public Works, which he had held since 1901. At the first meeting of the commission Mr. Treman was chosen chairman and Mr. Mead secretary.

One of the first acts of the commission was the sending out of nearly a thousand circular letters to boatmen, forwarders, marine insurance officials, shippers, boat-builders and other persons or organizations which were supposed to have the interests of the canal at heart, asking the recipients to submit whatever helpful sug-

gestions they could. A little later public hearings were conducted, one in Buffalo and one in New York. The commissioners also made a personal inspection of some of the Canadian canals and to add to all the information they could collect relative to the management of American canals the secretary of the commission visited Europe and there made a study of the operation and control of canals, harbors, terminals and canalized rivers.

Probably the greatest contribution of this commission is to be found in its recommendations concerning two essential improvements, one the establishment of a traffic organization and the other the adjustment of relationships between rail and water carriers which should not be inimical to the canal.

First we shall quote a summary of recommendations submitted by the commission in its report to the Legislature and then we shall examine in detail the studies which led to some of its conclusions. This summary, which includes the more important recommendations, is as follows:

"That the Superintendent of Public Works be continued in charge of the canals, and that the division superintendents be increased from three to four in number, section superintendents being eliminated.

"That a traffic organization for the canals be established, to the end that traffic may be diverted to the canal route and the State's commerce maintained and extended.

"To the end that interchange of traffic between railways and canals may be effected, that the Public Service Commission be given authority to compel extension of railway tracks to all canal terminals on such terms as may appear to be equitable.

"That such amendment of the statute shall be had as shall be necessary to prevent further disposition of any of the State's holdings of land under water or of water frontage excepting upon revocable leases, and that no lease should be for a greater term than twenty years.

"That the Public Service Commission be given authority to establish rates on through route and joint rates by railway and water carriers; and to prescribe a fair division of such rates; to prevent railway companies exacting from shippers more than they charge for same service if goods were shipped by rail under joint traffic agreement by connecting railroads; power to compel the issue of through bills of lading; authority to compel railways to charge less than local rates to all lake, river and sea ports on

through traffic to be exchanged with boat lines engaged in the domestic trade unless prorating arrangements already exist; authority vested in the Public Service Commission to compel fair treatment of canal-borne traffic by railways, and, further, to determine elevator and service warehouse rates, and maximum tug or other tractive power rates.

"All water lines operating within the State, whether controlled by corporation, company, firm or individual shall by statute be declared to be common carriers.

"That terminals and terminal equipment be operated as a separate bureau under the direction of the Superintendent of Public Works, and all accounts kept separate from maintenance and operation of the canals proper.

"Creation of a chief harbor-master, with local harbor-masters in charge at each terminal.

"That the Superintendent of Public Works be authorized to levy terminal charges against commodity tonnage, subject to the approval of the Canal Board, the rates being only sufficient to cover cost of upkeep and operation of terminals, the revenue therefrom to constitute a sinking fund to be devoted to repair and extension of terminal equipment.

"That the Public Service Commission be given power necessary to enable authorization of the use of surface lines for goods delivery purposes in terminal cities.

"That separate quarters in terminal storehouses, special berth, piers, cranes, and other utilities be assigned at terminals for the accommodation of package freight.

"That the Superintendent of Public Works, the State Engineer and Surveyor, and the Canal Board be given authority to grant owners of land adjoining canal waters authority to construct graving-docks, under proper restrictions.

"The enactment of a statute prescribing stringent rules for the transportation of explosives through the canal, and forbidding the mooring of boats carrying explosives, petroleum or any of its by-products, in basins or at any point excepting such place as may be specially prescribed by the Superintendent of Public Works.

"That steps be taken for charting and lighting of the river and lake portions of the canal uniform with federal regulations governing such matters.

"That provision be made for the installation of a complete telephone system, on the canals.

"Appropriations for the procurement of new repair machinery and hydraulic dredges.

"The repeal or amendment of several minor statutes in the interest of consistency, and to the end that an adjustment to new conditions may be made certain.

"That a more comprehensive method for disposing of abandoned canal lands may be made, to apply to the lands that will be abandoned as a result of the placing of the improved canal in commission.

"Modification of civil service laws affecting skilled operatives in the Department of Public Works.

"Amendment of statute so as to increase maximum speed of craft in river and lake sections.

"Maximum dimensions of craft to be left to Superintendent of Public Works to determine."

Among a few minor recommendations may be mentioned three—one that the Superintendent of Public Works should have full authority in matters of sanitation on the canals, another that he in coöperation with the Canal Board should have such jurisdiction over private docks and terminal equipment as to prevent them from being a menace to State terminals, and the third that the law be amended so as to allow greater speed on the canals than the four or six miles then permitted on various sections.

It will be observed that certain of these recommendations are but echoes of recommendations made by the Terminal Commission in its report in 1911. The first, third, fourth, fifth, sixth and ninth items of the summary just quoted are of such character. These relate to the administration of the canal being entrusted to the Superintendent of Public Works, the retention of State lands, the fixing of terminal charges and the regulation of canal and railroad relationships.

In recommending a traffic organization the commission was trying to cure one of the most pernicious ills of the whole canal system. To illustrate the gravity of the situation the report pictures what would happen if a railway should adopt the methods employed on the canal. This railway would maintain its trackage but the cars would be owned and operated by individuals. When a shipper had goods to send he would be obliged first to find an owner who had a car available for the service and then to bargain with him, since there would be no fixed rate for the use of the car. The only standard to guide in determining this rate would

be what some other individual had asked in payment for a similar service at a particular time. With such a condition, the commission points out, there would be chaos and neither the shipper, the consumer nor the car owner would be benefited; no one indeed excepting possibly a competing railway with systematized methods and highly developed regulations, offering through and combined rates to destination, would be the gainer.

"Yet this very condition, premised in the case of a railway company," to quote the report, "is the one that has been in existence on the canals since they were first placed in commission. There has been no unison of action on the part of individual boat owners; no guarantee, little assurance, no promptitude in the service, no energy in building up a clientele, no harmony of interests, no care for cargoes, no combined rates, no advance rate on which a shipper might depend as a basis for figuring on transportation; and the safety of the cargoes has been so little regarded that even the marine insurance companies have thought it necessary either to exact a greater rate than the cargo could properly stand or withhold insurance altogether. If the Barge canal is to be a success, system, capacity, reliability and stability must be substituted for the chaos that heretofore has ruled."

If objection be raised to the maintenance of a traffic bureau on the ground that such action becomes paternalism, the commission answers that the line into paternalism was crossed when canal tolls were abolished. If it be contended that the State should not enter into competition with railways which enjoy State charter and contribute a corporation tax in support of the State government, the answer is that the idea that railways and canals are competitors has been discarded abroad, is fast being discarded here and will be wholly discarded if the era of water-borne traffic on which the country seems to have entered develops to its promised proportions. The truth of the principle that the rational relationship between canals and railways is complementary rather than competitive was proved by universal experience in Europe. So thought the commission, and it believed also that the establishment of a traffic bureau, although its acknowledged aim was to divert traffic to the new canal, would neither infringe on the rights of railroads nor for long do violence to their interests.

In going still farther and trying to secure coöperative relationships by compelling physical connections and a free interchange of freight between canals and railways the commission realized that

it was dealing with a delicate question. Until the European idea of mutual benefit became more general any legislation looking toward compulsory coöperation was apt to be viewed as offensive, unjust and actually infringing on corporate rights. Nevertheless it was so important a question that without its settlement in favor of the canals their success, notwithstanding their natural advantages of cheap transportation, was a matter of grave doubt. This was a question, moreover, which had been much studied by Federal, State and municipal officials throughout the country. In the recommendations quoted we have seen in brief form how the commission proposed to solve the problem for New York State, and the solution it suggested was in close accord with Federal action for regulating interstate and foreign commerce. We shall see a little later that the commission's recommendations on this subject were enacted into State law.

In considering the regulation of the canal terminals the question arose in the minds of the commissioners whether the constitutional provision prohibiting the imposition of tolls on persons or property transported on the canals could be construed to mean that no charge might be made for the use of terminal facilities. The law authorizing the terminals mentioned certain charges, which were to be established by the Canal Board and collected by the Superintendent of Public Works, but of course this law would not hold against any constitutional dictum.

The commission argued that canal terminals as now conceived did not exist when the constitutional amendment was passed, and reached the conclusion that no fair minded person could claim that it was ever intended by any one who had to do with authorizing the terminals that their facilities, including human and machine labor, should be furnished free by the State or that any equipment except the channels themselves should be free to commerce. Moreover it was not believed that commerce was in need of any such wholesale subsidy.

There are only two other recommendations which we desire to consider in detail. One concerns the charting of river and lake channels and the other the use of surface railways for distributing canal cargoes in cities and villages. It is obvious that a waterway having a channel somewhere within the broad expanse of river or lake area rather than confined within its own fixed banks needed charting. The suggestion was that the Federal practice be adopted. Eventually, as we have already seen, the channels were buoyed and

lighted to accord with this practice and the Federal government was even persuaded to make charts, through its Great Lakes Survey organization, of the New York State canalized streams and lakes. In addition the State also has issued certain navigation charts.

The suggestion to use local railways to distribute goods was excellent. It was in line with a use of such trackage already being made in many American cities and in suburban territory to a limited extent, but as yet the companies carrying on this traffic were usually working independently of connecting lines and particularly had no connections with water carriers. Where comparisons had been made between this method and ordinary carting with horses the latter had been found to be two and a half times more costly. It was the thought to use these distributing lines at night or at times other than the rush hours.

There was one dissenting voice in the commission's report. Mr. Bense! differed from the others, chiefly in desiring to have the administration of the canals vested in a commission to be created for the particular purpose rather than to have the Superintendent of Public Works continued as the managing head. Mr. Bense! believed that the welfare of the canals demanded their control by a body divorced from any one State administration, of a somewhat permanent character and composed of experts who should give their exclusive and continuous attention to the work. This form of management, he thought, was the prevailing tendency in institutions of public concern, such as canals. In closing his dissenting report, Mr. Bense! says:

"Referring to the summary of the recommendations made by the majority of the Commission, I would respectfully submit the following divergent opinions:

"First.—That the charge of the canal be in the hands of a commission with full power of organization, that they may establish traffic on the new canal.

"Second.—That such a commission, with the approval of the Public Service Commission, be given authority relative to the extension of railroad tracks to all of the canal terminals.

"Third.—That such a commission be given authority to establish joint rates with railroads for carrying on through routes, subject to the Public Service Commission, and to compel the issuance of through bills of lading.

"In regard to the recommendation about terminals and terminal equipment, I would respectfully recommend that this matter be left to the management of a canal commission.

"Such a commission should also, in my opinion, be authorized to fix terminal charges over a commodity handled at the State's canal terminals, and further, that the commission above recommended have full authority to arrange and to permit the use of the storehouses, piers, cranes, etc., and to permit the construction of graving docks on lands adjacent to the State's canal lands, and to enact such rules and regulations in regard to the transportation of materials as may be determined necessary from time to time by the commission.

"And, further, authorized to install telegraph and telephone systems along the canal system, and to have whatever authority that will be necessary for the expenditure of moneys to light, repair, and maintain the canal, such as may seem to them expedient in order that proper commercial use may be made of the State's canal system."

CHAPTER XIV

A REMARKABLE FEAT — RAPID COMPLETION UNDER RESTRICTIONS AND STRESS OF WAR

Prediction of Completion—New Conditions Tend to Delay Completion—New Incentives Incite to Greater Zeal—State Engineer's Speech—The Goal—Summary of Hindrances—Expedients Used near Rochester—Difficult Situation near Lyons Overcome—Swift Action at Tonawanda Needed—Irondequoit Trough Completed by State Forces—Resourcefulness Solves Baffling Railroad Problem—Energetic Efforts Prevent Bad Slide from Being Fatal Hindrance—Final Work Completed Just in Time—Ceremony of Removing Last Barrier—Comparison with Removal of Last Barrier in Original Erie Canal.

AS THE various sections of the Barge canal were completed, if their locations permitted, they were thrown open to navigation. Additions were thus made from time to time as we have already seen and ordinarily these were regarded simply as natural occurrences in the course of progress, no very unusual efforts being employed to bring them about and little heed being paid to them by others than those directly concerned. But the days shortly preceding the opening of sections that would make the whole new canal from one end to the other available for full-sized traffic were accompanied by rather dramatic scenes. Several years before this period State Engineer Williams in an annual report had predicted that on a certain date the channel would be finished. But between this prediction and its realization the United States had entered the World war and, although new difficulties had arisen to prevent this accomplishment, new reasons had come which seemed to make its attainment imperative and also new incentives were impelling the builders to try the harder to reach their goal. Every patriot was desirous of doing his utmost for his country and because of the assistance a completed deep canal between Great Lakes and ocean might render in emergent war-time needs there fell upon those conducting canal affairs a deep sense of obligation to let nothing short of absolute impossibility stand in the way of opening a full-depth channel at the earliest moment. But, because the war had brought new industrial conditions, it did not seem humanly possible to advance the time of completion ahead of the day already predicted — the opening of navigation in the spring of 1918 — and so the ful-

fillment of that promise became a most solemn and compelling patriotic duty to the State Engineer and the members of his department, to the Superintendent of Public Works and his assistants, and to the contractors and their men.

When this prediction was made, at the close of 1915, its consummation while not easy at least did not seem impossible, but as the time drew near and difficulties and hindrances multiplied it appeared on many critical occasions that the way to success was impassably blocked. The story of the weeks and the months of this fight against seemingly insurmountable obstacles is most interesting, especially the account of the latter days of the contest, when again and again some almost tragic mishap occurred or some new and well-nigh insuperable barrier arose, and defeat was turned into victory only by indomitable perseverance and determination as well as the exercise of ready resourcefulness. The men who spared neither strength nor courage in this all but unequal struggle are worthy of high praise. Their patriotism and their zeal demanded as a reward the complete fulfillment of their expectations. That the canal was not allowed to play the part they anticipated was not because of its lack of fitness nor does the fact detract from the honor due these men. But we shall speak of this later.

To read aright this tale of completing the canal in time to serve a military necessity, we must recall the spirit of the times and feel again the thrill of war's impelling motives. Perhaps we can do this best by jumping to the end of the story and hearing first what the State Engineer said on the day the canal was opened. In the evening of that day, May 15, 1918, a company of about a hundred, engineers and contractors, gathered at dinner at the Hotel Rochester in modest celebration of the event. State Engineer Williams was the guest of honor, as being the controlling spirit of the accomplishment, and his speech was reported as follows in a Rochester newspaper the next morning:

"Probably there is no man in the city of Rochester tonight outside of this room—mark the exception—who has greater cause for gratification than I. At a time when it is almost providential in its occurrence the Department of the State Engineer has been able to throw open to public use a route of transportation in that part of the country where it is most needed.

"The war has been in progress a little more than one year, so far as our participation in it is concerned. We are told that food will win the war, that money will win the war, that men will win

the war, and each of these is a factor without which we cannot win, but underlying everything else as a prime necessity is transportation.

"Every true-hearted American is anxious to do his part in making certain that liberty 'shall not perish from the earth,' but this duty is not entirely taken up with the handling of bayonets and bombs and airplanes and artillery. You men who have strained your nerves and worked your hardest to get this canal open, so that it might carry the necessities of war, have rendered to your country a service whose effect on the decision to be reached in Europe may outweigh the work of an entire army corps. Let not one of you regard lightly what he has done or the part he has played. Engineers and contractors alike, you have served the great cause perhaps better than you know.

"I do not know what caused this war — commercial ambition, lack of territory, what not — but I do know that what we have completed today will most certainly be a factor in speeding the war's conclusion, and that after a victorious peace the canal will take the place it was originally designed to occupy — a successful and economical means for peaceful transportation of the products of the industry of the people of the great commercial state of New York."

In the spring of 1916 the State Engineer had taken a careful inventory of what remained to be done in canal construction and had fixed as a goal that which he had predicted shortly before, the completion of the channel throughout its entire length for the opening of the navigation season of 1918. A year later the United States entered the war and immediately all else throughout the country became secondary to what was most essential for carrying on the conflict. It was seen that under the new conditions it would be most difficult to adhere to the original canal program and it would have been very easy and perhaps scarcely reprehensible under the circumstances to have abandoned the effort and thrown the responsibility on unforeseen vicissitudes of war. But the men of the State Engineer's department were not of a temper to accept defeat thus easily and it was decided to put the program through.

Fortunately for the success of the venture these men had but vague prescience then of the difficulties that were to beset the way or the mountain-high obstacles that were to tax their utmost abilities. Most of the difficulties were due to war conditions. Labor and materials had increased enormously in cost and were hard and some-

times even impossible to get at any price. Transportation routes were congested almost to a standstill. Shipments of materials were sometimes lost and often they were commandeered en route for Government construction. Embargoes almost without number were in force against shipments. The necessity of obtaining priority orders to allow any shipments to be made involved vexatious delays and moreover canal work never was given a class "A" priority rating. There was an acute shortage of coal. Men engaged on canal contracts were frequently taken for army service or were drawn into shipyards or munition plants. An extreme instance of this latter practice may be cited. The erection of the railroad bridge at Brewerton was begun six weeks before May 15. If this bridge were not erected, navigation would be blocked. Three full gangs of erectors were lost one after the other within a period of five weeks by being taken to shipyards, but nevertheless on May 15 the bridge was ready. At another railroad bridge, one at Pittsford, much the same thing occurred and this bridge too was completed on time. But to cap it all there were also hindrances not attributable to the war. As the strenuous year of work advanced and unexpected delays occurred, the more necessary it became to increase the speed on the remaining work. This made the winter of 1917-18 one of intense activity. But it so happened that this winter brought more severe weather conditions than had been experienced in many a year.

To appreciate the magnitude and the difficulty of the task we must learn how the several obstacles were met and overcome, and to do this we must examine a few of the more conspicuous of these in detail. In this study we shall see also what expedients were employed when the carrying out of earlier plans was barred. We shall perceive that several pieces of work were so interdependent that the doing of one necessitated the doing of the whole series in proper sequence and failure at any point would have broken the chain and prevented the canal opening. We shall realize how on several occasions the defeat of the whole plan of opening the canal on the appointed day was averted by the narrowest margin. Moreover the pieces of work we are about to examine were not small in volume. One contract alone, that at Lyons, involved a cost of over \$850,000 and required the employment of a large plant of high-grade excavating machinery.

At the beginning of 1917 the greater part of the work remaining to be done was situated in the vicinity of Rochester. It was realized that all which remained in this locality could not be completed by

the spring of 1918, but fortunately much of it was located on the spur that stretches from the main line of the canal to the Rochester terminal harbor. The scheme of canal construction at this point has carried the main channel south of the city and across the Genesee river in a pool formed by a dam which is placed about two miles downstream, in fact almost in the heart of the city. Before 1917 was far gone it became evident that this permanent dam could not be completed and so a temporary structure was erected, which would maintain the pool at the crossing of the river and give a main channel of full depth for through canal traffic. But this plan would cut Rochester off from any possibility of being reached by canal boats during 1918. Accordingly a lock was built in the old canal where the new channel joined it west of the city and the old canal was used for access to the city. Of course only old-sized boats could navigate the old waterway, but it was the best that could be done and Rochester had to be content. Even to carry out this program of expedients unflagging, zeal and persistent effort alone achieved success.

In the spring of 1917 it became evident that the contractor working in the vicinity of Lyons would not finish his section in time for the proposed opening. Here was an instance of interrelated pieces of work. Dependent on the completion of the channel in this vicinity was the removal of the Montezuma aqueduct, the structure which carried the old canal across the Seneca river and which had to be removed to make way for the Barge canal channel in the bed of the river. While the aqueduct stood there would be navigation within the old channel; to navigate the new canal the structure must be removed; but with the aqueduct gone and the Lyons section not completed there would be no navigation, either by the old or the new route. It was vitally necessary for the plan of completion, therefore, that there should be no uncertainty about finishing the Lyons work. To insure this result the Canal Board terminated the contract and instructed the Superintendent of Public Works to proceed with the work. With his larger resources he was able to make such progress that it was safe to demolish the Montezuma aqueduct after the close of the 1917 navigation season. Both the Lyons section of new canal and the removal of the aqueduct were completed on time.

In Tonawanda creek was another case of interdependent conditions. To make possible a Barge canal channel it was necessary to remove a dam which maintained the level in the creek for old canal navigation. This dam had to remain in place of course till

the end of the 1917 season. After it was removed old canal navigation was destroyed and the new channel could not be used till several railroad and highway bridges spanning the creek had been rebuilt or underpinned, and this bridge work could not be begun until the dam was removed. Swift and well-planned action was demanded here.

As the appointed day drew near it became evident that the great concrete trough which carries the Barge canal on a high embankment across the Irondequoit valley and also some adjacent excavating could not be completed on time by the contractor doing the work. With only a few weeks left the State suspended this contract in March, 1918, and undertook the task of completion. By assembling men and machinery from every possible source the Superintendent of Public Works was able to speed up operations and finish in time. In other instances also men or plants were transferred from the less critical to the more critical points. For example, the contractor working on the Rochester harbor was ordered to shift his excavating machines to the main line of the canal.

Only a few weeks before May 15 it was seen that the stringent condition of the market would not allow the Pennsylvania Railroad company to obtain the steel for its crossing of the Barge canal just west of the Genesee river. For a time it seemed as if this failure would frustrate the whole scheme of opening the canal. By ready action, however, it was arranged to divert the entire traffic of this road, first to the Erie railroad, then to the West Shore railroad and then back to the original line. Thus the Pennsylvania embankment could be cut and this was done just in time to let the water through for the opening day.

As the time drew nearer and nearer the tension under which all had been laboring grew more tense. Day and night the work had been going on, three shifts of men being used in some places. Any mishap now, it seemed, would be most disastrous. On May 1 it looked as though the junction lock west of Rochester could not be completed, but by supplying the contractor with men and teams from among those collected for the Irondequoit job delay was averted. Ten days before the date for opening the canal came the mishap which appeared for a while to be the fatal last straw. The banks in a portion of the canal located in Tonawanda creek slid into the channel. At first a delayed opening seemed inevitable, but by most energetic efforts a hydraulic dredge was rushed to the spot and within twenty-four hours after the slide occurred was at work



Channel in concrete trough, across Irondequoit valley. With water in the canal only the tops of the heavy side walls, 96 feet apart, are seen. Two courses of concrete, with tar felt waterproofing, form the bottom. The Irondequoit trough is just three-quarters of a mile long. Maximum height of top of embankment above valley, 60 feet.



reopening the channel. At the guard-lock east of the Genesee river, however, was enacted the most dramatic scene of all. Night and day the men worked and on the morning of May 15 with the incoming canal water rising around their waists the final work was done. This was also the final work of all that needed to be done before a Barge canal channel of full depth could be opened across the whole state from end to end of the new waterway. The seemingly impossible task had been accomplished; the canal was opened on the appointed day.

We can appreciate now with what satisfaction the men gathered on the evening of May 15 in unpretentious celebration. These were the men, the comparatively small company of engineers and contractors sitting there at dinner, who had led the forces in the mighty undertaking which had culminated that day in success. But the world did not applaud. It was at grips with death just then and did not so much as hear of the event. Even the people of New York state were too absorbed to give it more than a passing glance. In peace times this would have been a momentous occasion. In reality it was significant, but everybody was then engaged in heroic tasks and this passed as but one among the many such deeds.

A few days earlier there had been a very modest ceremony connected with the last stages of preparing the canal for opening. The new canal channel on both sides of the place where it crosses the Genesee river had been dug as dry excavation, since more rapid progress could be made by that means, and a narrow dike had been left at each river bank. On May 10, in the presence of a small company consisting of members of the engineering staff and a few prominent citizens, State Engineer Williams, with a shovel taken from one of the laborers, opened a ditch across the dike at the western bank of the river, letting the waters of the Genesee through to the new channel. This was the last barrier in the whole new waterway. A half hour earlier the dike at the east river bank had been similarly cut.

By way of comparison it is most interesting to refer to what the chronicler of the original Erie canal had to say concerning the removal of the last barrier to through navigation on the first State waterway. The place of final work was at what the early builders termed the "mountain ridge," just west of Lockport. Here was "the spot," said the narrator, "where the waters were to meet when the last blow was struck," and where "nature had interposed her strongest barrier to the enterprises and the strength of man." This

phrase indicates a marvelous difference between the two undertakings. To the earlier builder the excavation of rock was a supreme difficulty. But no longer has rock excavation the terrors of old. The wide and deep channel of the Barge canal through many rock cuts has occasioned no anxiety. Modern machinery has wrought the change. A comparison of the methods employed at this mountain ridge in building the first and the latest canals presents at least one particularly interesting commentary on the differences of the times. Hand labor and crude horse-driven derricks were the tools of the early builder. For the Barge canal the old cut through this same mountain ridge has been deepened and widened, but in doing the work man used his head instead of his hands. The great cataract at Niagara, operating through powerful modern machines, was the *génie* which the builder of today commanded to carve the new channel.

CHAPTER XV

UNITED STATES CONTROL

Canal Completed in Time for War Use—High Hope of Result of Government Control—Call for State Canal Convention—Marshaling National Transportation Media—Government Investigates Barge Canal—Action by Canal Convention—Delays—Government Assumes Control—Announcement Hailed with Joy—Disappointment Follows—Nature of Federal Control—Review of Situation by Mr. Gardner—Interview with Director General of Railroads—Unsatisfactory Results—Superintendent Wotherspoon's View of Federal Control—Other Views—Clamor for Return of Canal after War—Official Opinions on Effect of Continued Control—Federal Domination Somewhat Lessened—Control Transferred to Secretary of War—Opinion as to Reason for Action—State Attempts to End Control—Hearings on Resolution to Return Canal—Government Operation Continued Another Year—Résumé of Federal Control and Arraignment for Its Inefficiency.

WE HAVE seen how by almost superhuman efforts the State Engineer and others of his department, assisted by the Superintendent of Public Works, the contractors and their many workmen, had succeeded in opening a channel of full depth throughout the entire length of the Barge canal for the beginning of the 1918 navigation season. It was a magnificent spectacle. Driven by the spur of unselfish patriotism each had done his bit to complete the canal, and now it was ready to serve the Federal government in a great emergency, even at the time of its supremest need; it could relieve a congestion in the transportation of war munitions and equally essential industrial commodities that was becoming well-nigh perilous.

A few weeks before the canal was finished it had been announced that the waterways of the country had been taken over by the Federal authorities and would be operated, together with the railways, as emergent war transportation media. With considerable self-satisfaction, therefore, the people of the state, and especially those who had labored so hard to accomplish this result, congratulated themselves that they had thus been permitted to render no small service to their country, even deeming the opportune completion of the Barge canal at this time almost providential. If this were all of the story, we also could contemplate the event with equal

satisfaction, but the sequel presents a different tale. From the magnificent picture of exalted selflessness we turn, if we may credit the evidence, to one of sordid selfishness. We might almost consider the denouement amusing, were it not so serious. Perhaps it is indeed a rare joke to the opponents of the canal; certainly not to its friends. The account of Government control of New York waterways surely forms an interesting chapter in Barge canal history but in its ultimate outcome it is one which cannot be recalled with any complacency by canal supporters. Urged upon the Federal authorities through a high sense of patriotic duty, this control fell to a base misuse of authority for selfish ends; acclaimed as a means whereby years would be saved in building up a Barge canal traffic, it proved in the end to be almost a death blow to any hope of a successful traffic on the new waterway.

But to follow the history of this movement we must turn back to the early days of America's entrance into the World war. The first concerted public action in this matter resulted from the calling of what was termed, for the want of a better name, a State Canal Convention. This body met in Albany on August 1, 1917, its purpose, according to the language of the summons, being "to consider and devise measures to bring the Barge canal to perform the world service of which it is capable, to bring its great value as a means of transportation to the immediate attention of the national government, and to secure the coöperation of the Governor and the Legislature of this state for the achievement of these purposes." The initiative in issuing this call was taken by Frank S. Gardner, secretary of the New York Board of Trade and Transportation, but in reality the convention had been for some time in the making and was but the natural outcome of the unusual situation then confronting the country.

Prior to this convention, however, the subject had received much thought and attention and various activities related to it had been started. When the country had passed from a state of neutrality to one of belligerency it began the mighty task of marshaling its resources, a task made greater by the very abundance and diversity of those resources, and among the multitudinous problems it encountered, that of transportation permeated them all. Those in Washington who had to do with these matters appreciated the important place waterways held in any plan to utilize to the full the transportation agencies of the country and accordingly the Department of Commerce, after a quick survey of the situation under the

personal direction of Secretary Redfield, had inaugurated a campaign for bringing about the use of these waterways, appealing to the country for a full utilization of existing facilities and urging upon citizens and communities the rehabilitation of worn-out and the building of new equipment. Then a bureau of inland waterways was organized in the Department of Commerce, with a transportation expert at its head. This department was working in close coöperation with the National Council of Defense, which also had appointed a special committee on waterways. In addition State Engineer Williams and Superintendent of Public Works Wotherspoon tendered to the Government the canal as it then was and offered their own services and those of the State to hasten its completion as soon as was humanly possible. Because of his former army position and acquaintances General Wotherspoon's words carried especial weight. Also George Clinton brought the matter to President Wilson's attention and was personally assured by the President that he would place the subject before the proper authorities with his full approval.

This agitation brought the Barge canal prominently before the Washington authorities and as a result the National Council of Defense appointed a subcommittee to tour New York state and investigate the canals. The report of these men was not made public, but it is generally thought that their impressions were not altogether favorable, at least so far as the immediate use of the canal was concerned. At that time, it will be recalled, certain stretches of the new canal were still to be completed, new shipping had not been built and the supply of old boats was deplorably inadequate. General Wotherspoon said that the two men constituting the committee to tour the state came in response to his correspondence with General William M. Black, the chairman of the committee on Inland Water Transportation, and were accompanied on their trip by members of his department, also that they expressed themselves as satisfied that the canal itself possessed all the physical and economical elements required for success, but that, as was obvious to everybody, the boats to make possible this success were lacking.

There was an apparent disposition on the part of all concerned, however, to utilize New York's waterway, but in spite of all that had been done, tangible results did not follow, either in using the canal or in preparing to use it, and the canal enthusiasts of the state grew restive. Believing profoundly that the Barge canal would be New York's greatest war contribution to the nation, they

were impatient of any delay in its service, and so the convention of August 1, 1917, was called.

This convention was attended by representatives of the State Waterways Association and many civic bodies, also the mayors of cities and numerous other prominent persons. Its action took the form of petitioning the Legislature, then convened in extraordinary session, to memorialize the President of the United States, the National Council of Defense, the Secretary of War, the Secretary of Commerce and the Committee on Inland Waterways, calling attention to the availability of the New York canals and urging their use to the fullest possible extent. The backing sought by this convention was obtained. The Canal Board by action of August 21 endorsed the movement; the Legislature three days later memorialized the Federal authorities and Governor Whitman formally transmitted the documents to President Wilson and other officials at Washington.

But it was several months before any definite action was taken. Meantime the canal was nearing completion. On January 31, 1918, State Engineer Williams appeared personally before the Senate Committee on Commerce, in the course of its investigation of matters connected with the building of merchant vessels under the direction of the Shipping Board Emergency Fleet Corporation, and informed the members that the Barge canal would be open throughout its entire length the following spring, but that boats for use upon it would be sadly lacking, and moreover that it was virtually impossible for private enterprise to construct boats, and if the canal was to be utilized as a military adjunct, it became the duty of the Federal authorities either to build the floating equipment or to assist by some method in providing it. Also various plans were submitted to the Government by individuals and these generally involved financial aid to private canal transportation companies, which it was proposed to organize.

Finally, however,—on April 10, 1918,—members of the inland waterways committee appointed by the director general of railroads, Mr. McAdoo, appeared before the Canal Board and requested the coöperation of the authorities charged with administering State canal affairs in an effort to bring about a coördination in the use of the railroads and the State canal system during the period of the war. This was just what canal men had been striving for and the Canal Board gladly assented. In the words of its resolution it “assured the director general that the officials of the

State of New York in charge of the operation and maintenance of the canals of the State were ready, willing and anxious to coöperate with the director general in the utilization of the canals to the fullest possible extent." A special committee of the Canal Board, in company with the Federal committee, at once waited upon the Governor and an expression of the willingness of the State to coöperate with the National government in its plans was formally transmitted by him to the Washington authorities. On April 18 formal announcement was made by the director general that he would secure boats and establish an operating organization to utilize the State canals.

This announcement was hailed with joy. Some persons went so far as to say that this use of the new waterway in the time of the nation's direst need would justify the cost of its building even if it were never used afterward. Canal advocates, besides being pleased because they seemed to have builded better than they knew, saw in the action of the Government the promise of an unexpected ally, nothing less than that which appeared likely to accomplish in months what it would naturally have taken years to bring about. They had realized what a herculean task was before the canal in the building up of a traffic, how only by years of unabating toil could commerce accustomed to other lines be diverted to the canal. Here was the hope that by what may be considered artificial means this metamorphosis was to be attained. Here was a supreme power, having absolute authority over all transportation, that at will could route traffic where it pleased. The usual courses were choked and it seemed inevitable that the canal would get a large share of this traffic.

But their dreams were not to come true. Neither were the expectations of the people of the state at large to be realized concerning their supposed munificent contribution to the country's emergent need. Gradually it became evident that these fair hopes were doomed to disappointment. First came the announcement that canal and rail rates were to be equal. Later this ruling was changed and canal rates had a twenty per cent differential. The official announcement that no private lines would be allowed on the canal elicited such a storm of protest that it was followed by a disavowal of any intent to forbid private operation of boats. To state in a word the history of Government control over New York canals it may be said that apparently the transportation lines were operated solely for the benefit of the railroads and that private companies

were in effect excluded from the canal because no one under existing circumstances would compete with the Federal government. Canal men believe that the railroad interests dominating the Government control deliberately misused their temporary authority to injure the canal, but of course positive evidence of such purpose is lacking. The retention of the waterways, however, after the railways were turned back to their owners, seems to indicate that some influence ill-disposed toward canals was working. But we shall let the men who were in close touch with the whole situation tell the story in their own words.

First, however, it may be well to explain the nature of the Federal operation of the New York canals. People in general had little understanding as to what had actually taken place. The State did not lose possession of its canals; under the Constitution it cannot. Moreover it still continued to maintain and operate both the channel itself and its structures, just as it has always done, bearing all the expense of this operation. The State's position in regard to its canals was scarcely changed in any particular. Unlike its administration of the railroads the Federal government did not guarantee the payment of dividends nor provide for the upkeep of the property, nor in fact did it assume any financial obligation whatsoever connected directly with the canal itself. This fact should be remembered for a better appreciation of the Government's attitude toward the canal, as it is revealed by the men we are about to quote. What the Government really did was something which the State had never done, namely, to take over control, either directly or indirectly, of the floating equipment on the canal. Its position was somewhat analogous to that of a large transportation company which was building boats and operating them on a State-owned canal. It obtained control of a large proportion of the boats that had been in use during recent years and built some new boats. The Government, however, was much more than a mere transportation company, for it stood ready to control all shipping on the canal, assuming the right under authority of Congress to commandeer any and all boats doing business on the waterway and even to direct the activities of those it did not commandeer.

At the convention of the State Waterways Association on November 7, 1918, Frank S. Gardner, the man who had conceived the idea of the special convention of August 1, 1917, told of an interview certain New York representatives had with the director general of railroads. What he said is enlightening. It runs as follows:

"Mr. President and Gentlemen: At the request of Senator Hill, I have put on paper a few facts regarding our interview with Mr. McAdoo in Washington on the 25th of last month, what he said, and the result of his policies.

"The conditions existing upon the canals of the state which have been created by the policy of the Railroad Administration constitute a cause for much concern to the state and to all of her business interests, and I venture to suggest that this Association at this time consider what steps should be taken to protect our business interests under the circumstances.

"Most of the gentlemen here present are aware of the fact that the New York State Barge Canal Conference met at Albany on August 1, 1917, and petitioned the New York State Legislature, then in extra session, to memorialize the officials of the United States Government and to urge them to make the fullest possible use of our state canals for transporting to the seaboard the food and military supplies to maintain our armies, and the food and other supplies for the armies and people of our Allies abroad; that the New York Legislature on August 24, 1917, did so memorialize the Federal Government and that such memorial was formally transmitted by Governor Whitman to President Wilson and other principal officials.

"Some eight months elapsed without any definite action in the matter by the United States Government. At the end of that time the Federal Railroad Administration announced that it had taken over control of navigation upon the canals of this state. The general public were quite in a dilemma as to what actually had been done and the officials themselves of the Railroad Administration appeared to be in some confusion, because they and their representatives made announcements which were generally understood to extend Railroad Administration control over all operations of all boats upon our canals.

"Shortly prior to June 25, 1918, the Railroad Administration announced that canal and rail rates would be upon a parity, and that the usual differential would not be allowed to freight via the canals.

"This order as issued was understood as applying to all freight carried by canal whether in boats operated by the Railroad Administration or by private individuals and corporations. In fact a circular issuing from the office in New York of the Canal Section of the Railroad Administration announced that no private canal lines would

be permitted to carry freight upon the canals for their own account. This caused consternation among shippers and carriers by canal and was regarded as a calamity to this state and all of its business interests.

"The situation into which our canals were thus apparently brought was the subject of unfavorable criticism by a number of influential organizations and by many important newspapers, and soon elicited from the Chairman of the Canal Section a disavowal of any purpose to forbid private operation of boats.

"This public discussion was followed by announcement by the Railroad Administration, published June 23d, that the rail rates would be advanced 25 per cent on June 25th, but that the canal rates would be allowed to remain at the then existing rail rates. This was a partial recognition of the natural difference in rates between rail and canal and was made after a call had been issued for a meeting of the New York State Barge Canal Conference to be held in Albany on June 26, 1918, to consider the situation.

"The Barge Canal Conference on June 26, after full consideration adopted an address to the Director General of Railroads, expressing the views of the Conference, and appointed a committee to submit such views to the Director General in person. It also appointed a special committee of traffic men to prepare a statement showing the relation between rates by the canals and by the railroads, and the rates which should be charged upon them, respectively, and the reasons for a substantial difference between them.

"The Committee of the Conference was unable to get an appointment with Mr. McAdoo until the 24th of last month, nearly four months elapsing, and they then proceeded to Washington. On Friday morning, October 25th, they met Mr. McAdoo, who was attended by Judge Edward Chamber, Director of Traffic, Mr. Carl Gray, Director of Operation, and Mr. Oscar A. Price, all of the Railroad Administration.

"It was my privilege to be present at this interview, and several gentlemen who are attending your meeting today were also there. I listened with much interest and attention to what Mr. McAdoo had to say. The interview covered fully an hour and a half, and while much pleased with Mr. McAdoo's courtesy, patience and frankness, I was soon impressed with the fact a most grievous mistake had been made by our Barge Canal Conference on August 1, 1917, in appealing to the Federal Government to make use of our canals. In saying this I must confess that I had a part in bringing

about the action of August 1, 1917, which to me now appears to have been so fatal to the very object we desired to accomplish, viz.: to induce the Federal Government to take such measures as would result in the greatest possible use of our canals.

"I am now convinced, from what Mr. McAdoo said to us on October 25th, that the measures he has adopted and the policies he proclaims, will not result in the greatest use of our canals, but will wholly subordinate their use to the enhancing of railroad revenues and the non-use of the canals wherever their use can be avoided.

"With much frankness Mr. McAdoo assured us that boats when operated by private individuals or corporations would not be interfered with; that they could charge any rates they saw fit, and he was willing to guarantee that private boats would not be commandeered by the Railroad Administration, but as to this he could not speak for the Army or the Navy.

"In response to an inquiry referring to building new boats for private operation he said: 'If so much steel as would be needed to make a tenpenny nail—and it is just about as close as that—should be needed to carry on the war it would have to be so used and could not be devoted to building canal boats.'

"It was also brought out that the Railroad Administration had started practically all the usable existing boats, and as the discussion proceeded it was quite clear that, notwithstanding the promises of non-interference of private operation of boats, the obstacles created to private operation were insurmountable.

"He said that a number of steel boats and a number of concrete boats were being constructed for the Railroad Administration.

"He asserted that the Railroad Administration has full power to route all freight by such lines as it thinks proper, and, upon inquiry, defended the policy of sending boats empty from New York to Buffalo on the ground that to send them loaded, 'at any old rate,' would reduce the railroad revenues. He said he could not approve of the boats created by the Government taking rates so low as to reduce the revenues of the railroads.

"Mr. McAdoo was asked if the Railroad Administration would be willing to make arrangements by which freight could be shipped to interior points in the West or from such points to the East, via rail and canal on through shipment and through bill of lading, giving the freight the advantage of the lower canal rates for the water portion of the carry.

"Mr. McAdoo said he did not think the Administration could do that because it would destroy their rail rates.

"This being the policy of the Railroad Administration, for which Mr. McAdoo declared himself alone to be responsible, will result in subordinating the canals to the railroad policy and will keep canal rates upon an approximate parity with rail rates, and he further plainly intimated that, having the power to route all freight, it will not be routed via the canal so long as the railroads can carry it. This, manifestly, must dispel all hope for the greatest possible use of the canals in the near future or during the continuance of Railroad Administration control of navigation on the canals.

"In conclusion, therefore, I repeat what I said in the beginning. The conditions existing upon the canals of this state which have been created by the policy of the Railroad Administration, constitute a cause for much concern to the state and to all of her business interests, and I venture to suggest that this Association, at this time, consider what steps should be taken to protect our business interests under the circumstances." *

General Wotherspoon spoke at this same convention. The following words of his concerning Federal control are worth quoting:

"If any discussion were to be had as to the disadvantages of the Federal control of canal freight, I would mention particularly the fact that the entrance of private capital into the field was absolutely discouraged. Three reasons have been advanced for this condition: First, the available Erie Canal boating equipment had been secured by the Government, and individuals could not accomplish the construction of new craft in time to be used the present year, since no materials for boat construction could be obtained without the greatest difficulty.

"Second. The understanding that private companies, if formed would have been compelled to operate under the supervision of the United States Railroad Administration, with no guarantee that their boats would not be requisitioned by the Government for other purposes.

"Third. That no private companies cared to compete with the Federal authorities in canal business.

"It is true, of course, that so far as the second and third reasons are concerned, about mid-summer an effort was made by the National Government to relieve the impression that the field was not open also to independent carriers, but such announcements

* Ninth Annual Report, N. Y. State Waterways Association, pp. 48-51.

came too late for practical purposes during the present year at least. In this connection it is significant to note that from the day the announcement was made that the movement of canal freight would be controlled by the Federal authorities, I have had scarcely a single call from any interest having in mind the formation of a private boat company, while previous to that date hardly a day passed but the subject was discussed with one or more callers." *

In General Wotherspoon's opinion, however, the advantages of Government control during the first year of the new canal's operation outweighed the disadvantages. It was of the utmost benefit to the waterway during this season, he declared, that traffic should be under a centralized control, rather than that boats should be operated as individual units, as had been the general practice theretofore, and also that such service as was furnished should have been rendered by a dependable and responsible carrier. He considered, moreover, that the general merchandise service which the railroad administration had inaugurated at his suggestion was a long step toward bringing home to the citizens of the state the advantages of waterway transportation. Also in 1918 for the first time rates had been stabilized by publication in tariff form. He doubted whether the transportation of freight on a large scale could have been accomplished during the year without Federal control. As a matter of fact there was a complete absence of prospective carriers in sufficient numbers a year earlier. The field was carefully investigated at that time by the subcommittee of the National Council of Defense, as we have already seen, and while several companies then claimed a corporate existence none was ready actually to engage in business without considerable financial aid from the Government.

Although General Wotherspoon held this favorable opinion of the season's traffic, at the same time he advocated that Federal control should continue after the close of the war no longer than would be required to adjust business conditions on a peace basis.

A view of the situation which existed subsequent to the war is found in the following quotation. It comes from a paper read before the State Waterways Association on November 20, 1919, by Edward T. Cushing, of the New York Produce Exchange.

"It is for the interest of the government," he said, "to kill any competition of the canal with the railroads, for even if the railroads were returned to their owners, the government would

* *Id.*, p. 41.

still guarantee their earnings. No sane man will compete with the Federal Government. What an object lesson in paternalism! The fear of it is today paralyzing the operation of the greatest inland waterway in the world. Here is the biggest thing ever played for in railroad history. The stake—one hundred and fifty million dollars of the people's money invested in the Barge canal; the contestants—the United Railroads, backed by the Federal government, against the people of the state of New York.” *

Another quotation, this time from an address made by Edward S. Walsh, Superintendent of Public Works in 1919 and 1920, before the State Waterways Association at this same 1919 convention.

“I made every effort,” said Mr. Walsh, “to persuade the United States Grain Corporation to utilize the canal facilities, but without success. Explanation for the failure of the Grain Corporation to employ the water route, particularly when it was announced broadcast throughout the country that a serious car shortage was impending, did not explain. I, therefore, am forced to the conclusion that the routing of grain from Buffalo by rail to the utter exclusion of the canal, was either the result of poor business judgment or discrimination of the rankest nature against the waterways of the state.” †

With the war at an end and no longer any reason existing for continuing Federal control, State officials and canal advocates began clamoring for the Government to relinquish all authority over canal traffic and to cease operating its boats. But again they were doomed to disappointment and for two seasons more the United States authorities retained their hold on the canal.

Of the effect of this experience State Engineer Williams says in his 1920 annual report, “The designers of the canal had contemplated that it could not be expected to reach its maximum carrying capacity within a period of less than five years and this conclusion was arrived at without foreseeing the conditions of war, which have completely upset the ordinary and usual economic development that could have been reasonably looked forward to. In view of the almost prohibitive costs of material and equipment, it is doubtful if any new transportation medium of whatever nature

* Tenth Annual Report, N. Y. State Waterways Association, p. 16.

† *Id.*, p. 45.

could reasonably be expected to attain any marked development within the two and one-half years since the Barge canal has been opened. Our present rail transportation systems show little signs of material recovery from the staggering blows dealt them during the period named, although prior to the war they were justly presumed to be developed normally with the increased demands made upon them. To my mind, development of transportation on the canal has been set back fully three years, owing to the conditions through which we have passed and are now passing."

From the Superintendent of Public Works we hear further of this baneful influence and also learn what changes were taking place in the status of canal control. In his annual report, presented to the Legislature on January 15, 1920, Superintendent Walsh said:

"The task of restoring traffic to the waterways is a difficult one at best and nothing must be permitted to stand in the way of its progress. The first requisite in the undertaking is the formation of many strongly-financed, well-equipped carriers. I find there are men who look with favor on canal transportation projects and are eager to engage in the business under certain conditions, and one of the controlling conditions is that Federal utilization, control and jurisdiction of the waterways be discontinued. Few, if any, shipping men are willing to compete with a subsidized Federal canal service that operates without regard to cost and that assumes no obligation to produce a profit from its operations. The situation on the canals, therefore, if new companies are to be formed who will provide a service that will build up the tonnage, demands the termination of Federal control or utilization.

"I had believed the termination of the Federal Control Act, returning the rail system to their owners, would free the waterways from the obstructing Federal influence. Transportation legislation pending in Congress, however, does not definitely establish the status of the inland waterways on which the government had operated barges and it is proposed to transfer the government's inland waterway activities from the Railroad Administration to the United States Shipping Board, to be dealt with by the Shipping Board under the provisions of the 'Shipping Act, 1916.' If, in this manner, the government should continue its canal operations through the agency of the Shipping Board, the situation would be unchanged. There would still remain in operation a governmentally subsidized transportation service with which private enter-

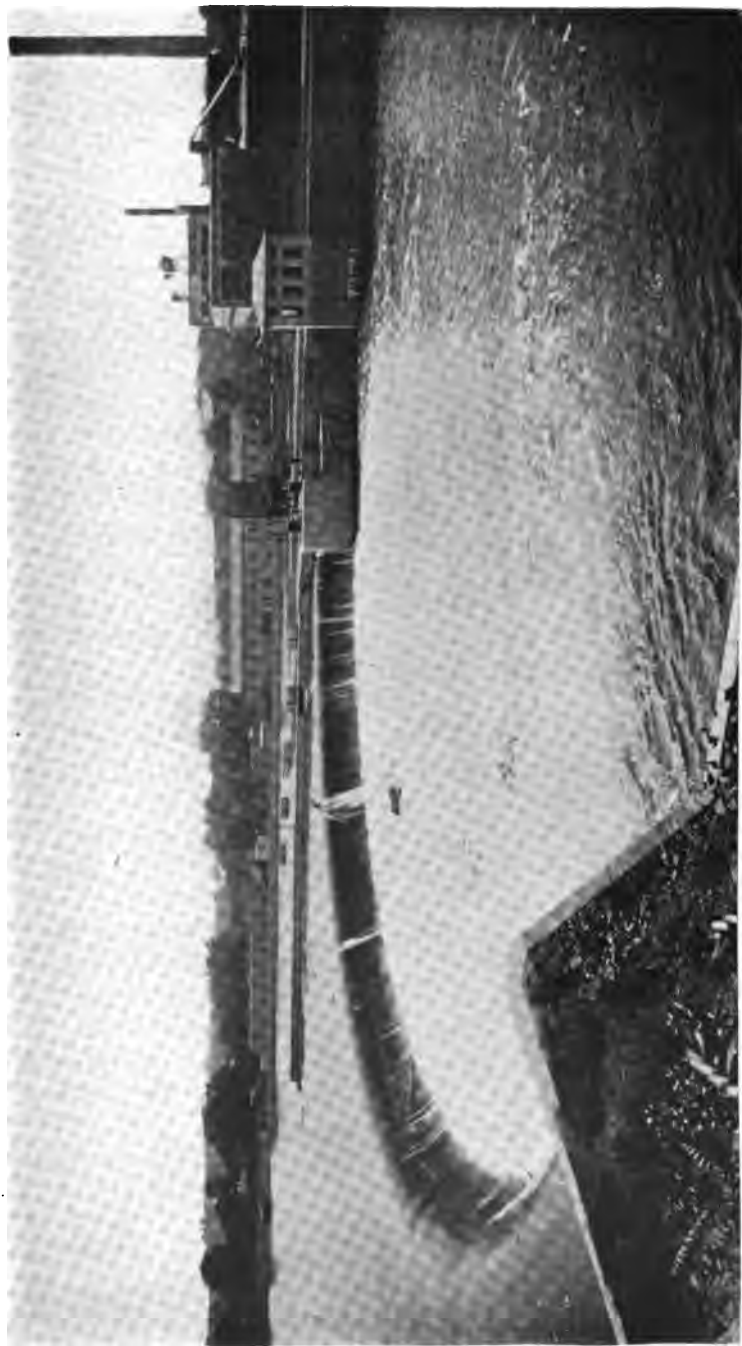
prise is reluctant to compete, in fact, with which it declines to attempt to compete.

"I do not understand that the Shipping Board is authorized under the Shipping Act to operate vessels or barges it controls, but must permit of their purchase, lease or charter when persons or corporations came forward with a proposition that satisfied the terms and conditions of the purchase, lease or charter prescribed by the Shipping Board. If, therefore, pending legislation will be the means of terminating the Federal government's activities on the New York waterways and of releasing government barge equipment for private operation, the problem confronting the State is solved. On the other hand, if the measure now before Congress does not have such effect, I urge upon your honorable body the imperative necessity of the introduction in Congress and early passage of legislation that will rid the waterways of the State of the destructive governmental operation."

In 1919, however, Federal domination was somewhat lessened in degree. This was brought about largely through the efforts of Superintendent Walsh and we shall let him tell of it in his own words. In this same annual report he said:

"In view of the disastrous effect of Federal control of canal rates and equipment, as practiced by the Federal government during the 1918 season of navigation, determination was reached early in the year to limit and modify the extent of Federal jurisdiction.

"Several conferences were held with officials of the United States Railroad Administration and agreement reached as to the scope of the Federal government's activities during the 1919 season of navigation. First, the Railroad Administration agreed to waive its option of recharter on the 100 or more individually owned barges that it operated during 1918. By this agreement the independent barges were released for operation by their owners. Second, the government agreed that it would not control or attempt to control, either directly or indirectly, the operations of such independent canal carriers as might be established nor the local rates such carriers might publish. Third, the government agreed to operate the barges it had built in a through Buffalo-New York service exclusively and would not enter into competition with independent operators in the intermediate territory. Fourth, the Railroad Administration officials agreed that they would not attempt to influence the movements of the grain traffic from Buffalo and



Fixed dam in the Oswego river, at Minetto. Nearly all of the Oswego canal is a river line, both old and new dams being used to effect this canalization. View shows a new curved dam of gravity type, built on the eastern side of the river, a lock in the center and power-plant head-gates on the western side.



that independent operators might compete for such traffic on equal terms with the government barges. Fifth, the government agreed to establish a line of rates applying from New England and New York via canal and lake to western territory and would restore a service on the Great Lakes to Lake Michigan ports. Sixth, the government consented to establish canal and rail rates through all practical points of interchange if and when traffic was created making such rates necessary."

Early in 1920 the railroads of the country were returned by act of Congress to their former private owners. It had been supposed that Federal jurisdiction over the New York canals also would cease whenever the railroad systems were given back. They had been taken under authority of the same act as the railroads, known as the Federal Control Act, and moreover it had been the understanding of New York State officials that Government tenure was merely for the period of the war. When the bill to restore the railroads was pending in Congress it was said that some provision would be incorporated which would have to do with the policy of the Government towards inland waterways. Accordingly those in charge of canal affairs in New York were at considerable pains to caution the representatives of the State in Congress against permitting anything to be embodied in the bill which would continue Federal activities on the New York canals. Also inquiry of the conference committees of both Houses having the bill in hand brought the response that there was no provision that in any way affected adversely the New York canals. Shortly before the passage of the bill, however, it was learned in New York state that this assurance was in error. The bill as proposed by the conference committee provided that all barges on inland and coastwise waterways acquired by the United States in pursuance of the Federal Control Act were to be transferred to the Secretary of War and operated by him, so as to continue the lines of inland water transportation established during Federal control. The meaning of this provision was clear. Under it Government operations on the New York waterways would be continued. The New York members of Congress were immediately urged to have the bill amended so as specifically to exclude New York canals from its provisions. The sponsors of the bill, the chairman of the House Committee on Interstate and Foreign Commerce and the chairman of the Senate Interstate Commerce Committee, both declared that prior to the drafting of this section of the bill they had been informed that the

Government had not taken over any transportation facilities on the New York canals nor was it engaged in operating any boats on them. Moreover, they were both opposed personally to such operation if it was not desired by the people of the state.

The explanation of this occurrence we can only guess at. Superintendent Walsh's interpretation, however, is illuminating. He says, "The inclusion of section 201 in the Railroad bill in the form in which it was submitted to Congress unquestionably resulted from a deliberate misstatement of facts by the person or persons with whom the Conference Committee consulted. It is inconceivable that the information given the Congressional Committee was founded on ignorance and if so such ignorance of the activities of the Government by Government officials is appalling. It is my personal belief whoever imparted the information to the Conference Committee as to the inland waterway activities of the Government wilfully concealed the truth as far as the New York State Canal situation was concerned."

Because of the importance to the whole country of the chief features of the bill, it could not be delayed to revise one relatively small item, however much that was desired by those directly interested. Accordingly the bill was passed, but shortly thereafter Senator Wadsworth introduced a resolution to exempt the Barge canal from its provisions.

On March 17, 1920, the State Canal Board adopted a strong resolution disapproving the continuation of Government operation of barges on the New York canals and declaring that in justice and fairness to the State all canal equipment used or acquired by the United States for Barge canal operation should be transferred in ownership to the State as a partial return to the State for furnishing, solely at its own expense, a waterway connecting the Great Lakes with the seaboard and placing it at the disposal of the Nation, and particularly in part compensation for what had resulted from the Government's canal operations in 1918 and 1919.

Immediately following this action the State Legislature passed a concurrent resolution of the same tenor as that of the Canal Board, but going farther and actually requesting the transfer of the fleets to State ownership. Copies of this resolution were sent to the United States authorities.

A hearing on Senator Wadsworth's resolution was called by the Senate Committee on Interstate Commerce, at which New York canal representatives appeared and argued that Government opera-

tion was inimical to the successful development of commerce on the State waterways and prejudicial to the best interests of the people of the state. The resolution was favorably considered by this committee and was passed by the Senate.

At the hearing before the House Committee on Interstate and Foreign Commerce the State commercial interests were again represented in force and once more they protested against a continuance of Government operation on the New York canals. The Secretary of War, on the other hand, vigorously opposed the resolution, and representatives of his department painted a wonderful picture of what splendid results would attend the continued operation of Government barges on the State canals under the direction of the War Department. And as a cap-sheaf for New York's humiliation, in the light of her former magnanimity, representatives of the South appeared before the committee and insisted that if the Government were to cease its activities on the New York canals then the boats it had constructed or was constructing for that service should be transferred to the Mississippi and Warrior rivers.

We shall let Superintendent Walsh tell how this action ended and also what happened on the canals during the ensuing season. In his report for 1920 he said: "Congress adjourned before action was taken by the House of Representatives on Senate Joint Resolution 161 and the Federal government, under direction of the Secretary of War, through the Inland and Coastwise Waterways Service, administered by the chief of the Army Transport Service, has operated a fleet of 95 barges on the waterways of the State during the navigation season of 1920. The equipment operated by the Federal Government is supposed to be the last word in inland waterway barge design. The power units employed cost nearly \$100,000 each. Twenty steel steamers, twin screwed, having 400 I.H.P. each and cargo capacity of 350 tons were in service. Fifty-one steel barges, 150 feet long, 20 feet wide, 12 feet deep, with a cargo capacity of 630 tons each; twenty-one concrete barges, 150 feet long, 21 feet wide, 12 feet deep, with a cargo capacity of 520 tons each, and three wooden barges of the same general dimensions were operated. The total cost of the fleet was approximately \$4,500,000."

We desire to add another quotation from Superintendent Walsh. He gives in this same report a brief résumé of Federal control on the New York canals in 1918, 1919 and 1920, the three years during which that control was in force. It is as scathing and as

fearless an arraignment of Government operation as the most rabid and the most sorely disappointed canal enthusiast could desire. It reads as follows:

"The Report of the Director of Inland Waterways of the United States Railroad Administration for the year 1918 excuses the failure of government operations on the ground that the equipment to be had was obsolete and inadequate and the time permitted for the mobilization of a fleet and perfection of an operating organization was too short to permit of efficient results.

"The report of the Government for the fiscal year 1919 shows a loss of \$506,807.38. The failure of operation is admitted but excused on the ground that the modern power units contracted for had not been delivered and such tow boats as were available for the movement of the new steel and concrete barges that had been delivered were inadequate.

"The report of the Chief of Inland and Coastwise Waterway Service for the fiscal year 1920, comprising only 45 days of the navigation season of 1920, shows a loss of \$62,670.14. The deficit for the entire season of navigation will unquestionably exceed \$500,000. Throughout 1920 the government had in service its full complement of floating equipment, the most modern and most costly of any on the State waterways. The season's cargo capacity of the fleet if operated with reasonable efficiency would have been approximately 600,000 tons. The alleged causes for the failure of operations of 1918 and 1919 did not exist in 1920 yet the results were relatively far more disastrous. The government barges carried 197,017 tons during the season of 1920. In my 1919 report I showed that while canal commerce increased 7 per cent in 1918 that proportion carried by the government line decreased 2 per cent. During 1920 the government barges carried slightly less than 14 per cent of the season's total tonnage, their proportion decreasing another 2 per cent despite the fact the very best equipment to be had was operated by the government and traffic was available in large volume, increasing about 15 per cent in total. A comparison of the barge activity of the government fleet with barges operated by others shows that the type of equipment characterized by the government in 1918 as 'obsolete and inadequate' worked with much greater efficiency. The War Department fleet engaged almost exclusively in the through Buffalo-New York traffic, the long haul trade, yet the average miles per day made by government barges was but 24.4 miles as against the 25.7 miles per day

made by independent boats. The average time per trip by government boats was 14.1 days, as against 7.9 made by the independent boats. One independent carrier having in service power units and cargo barges of the old canal type with a season capacity of about 120,000 tons carried during the year over 90,000 tons or 75 per cent of its capacity. Government barges carried less than 30 per cent of their capacity. Shippers have reported to the Department that government barges were as long as 75 days in transit from New York to Buffalo. Government barges with cargo valued at hundreds of thousands of dollars on which the shipper was paying interest charges laid at the Barge canal terminal in the city of Albany for several weeks. A time was reached when shippers of flaxseed from New York dissatisfied with the abominable service of the War Department line diverted their tonnage to the independent operators. Immediately the government decreased its rate on this commodity. The former rate was fair and reasonable. It is questionable whether the decreased rate was remunerative. The loss in earnings to one carrier resulting from the destructive competitive methods of the government would have been sufficient to pay a substantial dividend on the entire capital stock of the company.

"Not the least of the evils of government operations were in their effect on the commercial interests of the canal. The utter incompetency and rank carelessness of government employees manning the barges placed the canal structures in constant jeopardy. The movement of a government fleet was a serious menace to locks, dams and bridges. Navigating the waterway with complete disregard of rules and regulations the government boats wrought havoc with the channel buoy lights; badly damaged locks time and again; were in collision frequently with other craft; were sunk here and there in the canal channel, and in one instance almost completely demolished a bridge. Reports continually reached the Department that officers and crews on government boats were intoxicated while on duty and incapable of safely performing their duties. A rehearsal of the accidents and damage caused by the incompetent and careless handling of government barges would entail more space than may be permitted in this report. Suffice it to say that had the conditions cited resulted from the operation of barges by a private company the privileges of the waterway would have been denied that company. As it was, the impression prevailed that since the War Department's Canal service was conducted through Act

of Congress, the operation of the boats was outside the jurisdiction of the Superintendent of Public Works.

"Government operation on the New York canals in 1918 and 1919, under the Railroad Administration, was most deficient. Government operation under the War Department in 1920 was so replete with mismanagement, inefficiency and incompetency as to defy imagination. The fiasco of government operations in 1918, 1919 and 1920 demand that there be brought about an immediate termination of Federal operations on the New York State waterways. The people of New York have been compelled to assume a large share, nearly 30 per cent, of the million or more dollars lost by the Railroad Administration and the War Department in their ridiculous attempt to conduct a business enterprise. The commercial interests of the State demand that the government withdraw from business on the New York canals and cease competing with citizens of the State in a field where the government has no moral right to continue. To that end, I urge upon my successor and your Honorable Body the imperative necessity of early and forceful action that there may be introduced and passed in Congress legislation amendatory to the Railroad bill that will compel the immediate discontinuance of government operations on the Barge canal."

Federal control of the Barge canal was stopped in time to free the 1921 navigation season from boats operated by the Government. But Superintendent Cadle said in his report for the year that only through the most vigorous efforts of the Governor, the Legislature and State officials was this brought about. The Government boats were purchased and operated on the canal by a private transportation company.

CHAPTER XVI

A STATE CANAL TRAFFIC BUREAU

Bureau Recommended by Commission on Operation — Recommended by State Engineer — Character of Efficient Bureau — Bureau Authorized — Bureau Established — Activities of Bureau — Extension Recommended — Need of Further Activity.

IN OUR review of what was accomplished by the Commission on Barge Canal Operation we said that in recommending the creation of a traffic organization for the new waterway the commission was trying to cure one of the most pernicious ills of the whole canal system. Just why the State was so long in diagnosing this malady is hard to understand. No railroad, as the commission pointed out, could hope to succeed under the methods, or rather the almost utter lack of method, employed by the State. At last, however, the State did come to realize its condition and attempted to provide a remedy, but whether an adequate remedy without further action is still to be seen.

In creating the office of canal traffic agent the State made provision for undertaking a most difficult task. But how difficult and also how important that task really was we doubt whether the public at large or indeed many individuals have any sufficient appreciation. Perhaps we can get a partial conception of both its need and its immensity by listening to something the general manager of the Manchester ship canal said concerning that oft-cited waterway. We quote this remark in full elsewhere, but a brief paraphrase will suffice here. He said that, strenuous and exhausting as was the struggle to carry the authorizing bill through Parliament and great as was the engineering feat, these were as nothing to the tremendous task of diverting traffic from beaten tracks to the new route and only through organization and the employment of trained experts was this done.

There was no immediate response to the Operation Commission's recommendation. That which brought about the necessary legislation was doubtless a recommendation from the State Engineer, which was endorsed by the State Waterways Association and followed by a proposal by the Superintendent of Public Works to appoint a temporary traffic agent and a recommendation that such office be made

permanent. These suggestions, reinforced by active support of proposed legislation, secured the desired end.

Let us look for a moment at the State Engineer's recommendation. It was contained in his annual report for 1915, presented to the 1916 Legislature. Mr. Williams said, "Should a railroad be constructed at an expense of \$150,000,000 and its officials assume the policy of waiting for business to come to them, the stockholders might well complain. On the completion of the Barge canal and its terminals the people of New York State will have invested this amount in improving the canal system and to realize to the full extent on this investment, I earnestly recommend the establishment of a bureau corresponding to that of the general freight agent of one of our large railroads, which would furnish shippers information relative to water-borne transportation, and, to go still farther, would endeavor to encourage shipments whereby the canals might be used to their full capacity, thus insuring the people of this State a handsome return on the investment made."

A few months later in amplification of this suggestion the *Barge Canal Bulletin*, a monthly publication issued under the direction of the State Engineer, had the following to say in regard to what should be the character of the bureau recommended, which it denominated a State Traffic Bureau:

"As to the nature of the bureau, it may be compared to the general freight agent and the freight-soliciting bureau of a railroad. It would be nearly what these railroad departments are, but it would be something more. One of its chief functions may be described as educational and another as developmental, or assistful. It could not confine its duties to the narrow limits of a freight solicitor nor conduct its solicitations along the lines of a partisan railroad official. As a State organization it would have to be entirely free from partiality toward any one of the boat lines doing business on the canals.

"The primary duty of a State traffic bureau, like that of any traffic bureau, would be the giving of information concerning rates, routes, connections, distances, times of sailing, comparisons between water and rail costs and other allied topics. However, if a State traffic bureau is to fulfill its whole mission this will not be its chief duty.

"That the State and its citizens may derive to the full the benefit inherent in the improved waterways, the people who send and receive freight must have brought to their attention the advantages of water-

borne traffic. While this work is educational, it cannot be done at arm's length by the circular method. Someone who knows facts and conditions must come into personal touch with these people. That such a one will get a ready hearing from the transportation superintendents of large concerns and the managers of smaller firms, no one who knows the situation can doubt. The inadequacy of existing transportation systems and the congestion and delays, especially during the past six months, clearly point to the need and opportune advent of the new State waterways.

"Probably the chief beneficial service of the proposed traffic bureau, although its assistance may be soonest forgotten, will be its work of development. By knowing thoroughly the products and markets, not only of New York state, but of a wide adjacent region, the producer and manufacturer may be helped to extend and increase his trade and get his raw materials cheaper, and the consumer may learn how he can secure better goods for the same price he has been paying or the same goods at less cost.

"In a word, a State traffic bureau, to attain its high office, should be what any government bureau would naturally be supposed to be—an organization for benefiting the citizens of the state by assisting them within the particular field of its activity."

Again in his 1916 report, which was transmitted to the Legislature early in 1917, the State Engineer repeated his recommendation. It was about the same time that the Superintendent of Public Works suggested the new employee in his department, to be known as a canal traffic agent. Several chambers of commerce throughout the state endorsed these recommendations and the Legislature answered by passing an act (chapter 26) which added section 49 to the Canal Law and authorized the Superintendent to appoint a canal traffic agent "to collect and tabulate information and data relative to canal transportation, transportation of freight to and from localities which are feeders to the canal system, and rates and transportation costs to and from points beyond the limits of the canal system, by water and by railroad, when a portion of the route may be by canal." These data were to be so arranged as to be available to the public and also the publication of pamphlets for disseminating canal information, was authorized by the new law.

By July, 1917, the Superintendent had established a canal traffic bureau in his department and the work of compiling statistics and conducting an extended campaign of education had begun. In reporting to the Legislature on the founding of the bureau he said

that it must be borne in mind that in this campaign the prejudices to be removed were of long standing and that the present generation of business men had grown up with no knowledge of the possibilities of transporting freight by water, since waterways had ceased to be a factor for more than a decade and their use had come to have no place in the business plans of these men.

During the first year's activities of this bureau efforts were confined largely to the development of intrastate traffic, since the number of boats in service was very limited and joint rates and joint routes between rail and water lines were still to be adjusted. It was in 1917, as we shall see a little later, that the Public Service Commission was given authority over railroad and canal relationships. Pending the establishment of such coöperative rates and routes, it was thought futile to attempt to interest shippers in territory outside the state, inasmuch as the existing rates were prohibitive in comparison with all-rail rates. But considerable educational work by means of canal literature was carried on in these outside fields.

For extending the service of the bureau the Superintendent planned to have each harbormaster add to his terminal duties those of local freight agent and solicitor. Not only would they furnish information to the shippers in their respective localities concerning tariffs, routes and means of utilizing the canal, but they would be in intimate touch with the local situations and would report their findings to the Superintendent, being able to secure accurate data relative to the source of raw materials used by local manufacturers, the points to which the finished products were shipped, the character of service shippers required, the rates necessary to attract commerce, the building of new factories in their several communities and the industrial conditions generally.

Not much time has passed since the establishment of this bureau, but already considerable has been accomplished. The vast field still to be covered, however, is appreciated by those in charge of the work. As the Superintendent said in a recent annual report, "The task of reaching all of the many thousands who might advantageously ship their products by the canals is a large one and years of constant effort would be required before the merits of the 'Ship by Canal' campaign could be brought home to the majority."

It is along the lines of publicity and education that efforts are chiefly being directed. Conferences and meetings have been held with shippers and commercial organizations, not only those of the important cities and villages in New York state but of the Middle

West and New England as well. Large numbers of shipping representatives, industrial traffic managers, sales managers and others have been afforded an opportunity personally to inspect the canal in operation and get a first-hand knowledge of the conditions of navigation and the excellence of the terminal facilities. In this way prejudices against canal transportation, conceived largely through ignorance of true conditions, have been removed. As a means of reaching a much wider audience, the many who cannot be taken on an actual trip over the canal, there has been prepared a motion picture film which shows some of the prominent structural features of the waterway, the carrying of cargoes upon it and the handling of freight at its terminals.

To illustrate how even less important details are not neglected in the attempt to bring canal facilities to the attention of the public, it may be said that advantage has been taken of the immense amount of travel on the railways and highways paralleling the canal and large illuminated sign-boards have been erected at vantage-points, bearing matter briefly descriptive of the adjacent structure or channel and also pertinent canal propaganda. A somewhat similar medium of advertising has been a sign-board on boats, telling how many carloads of a given commodity a boat was carrying or such other appropriate words as would tend to arouse interest in the canal. Another form of sign-board has recently been placed rather generously along the highways even to a considerable distance from the canal, pointing the direction to the nearest terminal.

Were it not for the sadly inadequate supply of canal boats, the traffic bureau might have widely broadened its campaign of solicitation, doubtless with considerable success. The bureau has accepted as one of its duties the remedying of this defect. Whenever opportunity has offered, prospective transportation companies have been given all available assistance, in an endeavor to encourage the placing of more boats in canal service. As an instance of this policy there may be cited a pamphlet entitled, "Principal Requisites of Canal Carriers and the Potential Canal Tonnage," issued by the Superintendent in February, 1918.

One may get a comprehensive view of the work done by this bureau from a paragraph in the Superintendent's report for 1920. He summarized as follows:

"The activities of the Traffic Bureau are showing results. Constant solicitation has been carried on; shippers everywhere have been aided and encouraged to utilize the canal route; transportation

organizations have been fostered and assisted in acquiring cargo; rates have been initiated; routes developed; obsolete practices eliminated; new methods inaugurated; unfounded prejudices overcome; literature descriptive of the canal facilities prepared and distributed throughout the country; articles showing the value of the waterway and how it may be utilized furnished the press and periodicals; the interests of the waterway generally safeguarded; inimical legislation opposed; boats acquired for shippers; cargo obtained for boats and every effort made to rehabilitate commerce on the canals. That such efforts have been fruitful is to be seen in the increasing commerce of the waterways and the very apparent reawakening of interest among shippers in canal transportation."

The Superintendent went on to say that much more can be accomplished with a larger traffic organization and he recommended that it be extended by renaming the head of the bureau, calling him Traffic Director rather than Canal Traffic Agent, and giving him three principal assistants, one to be located at Buffalo, one at Syracuse and the other at New York city. Such, it is said, was the plan originally conceived and advocated by the shipping interests of the state, and these interests are urging that the time has come for expanding the bureau to this extent, since, if canal commerce is to grow, this organization must keep ahead of it.

We said that it remained to be seen whether the State had provided an adequate remedy for removing the prejudice against the canal and for educating the shipping public to an appreciation of the advantage of using the new waterway. The traffic bureau has accomplished much, probably all that could be expected, and we would not in the least degree disparage anything it has done, but when we learn, as we did recently, with what surprise the Congressmen from the Middle West found a well-equipped, modern canal instead of the shallow, inefficient channel they had expected, and when we see too how ignorant of the new traffic opportunities are the people of our own commonwealth, we wonder whether the State did not make an almost fatal error in waiting too long to begin its campaign of advertising and solicitation and also whether much more vigorous efforts will not be needed before converts to the ship-by-canal idea are added in sufficient numbers and the new waterway comes into its own.

CHAPTER XVII

REGULATING CANAL AND RAILROAD RELATIONSHIPS

Regulation Recommended by State Commissions—Importance of Rail and Water Coöperation—Review of Question—Hostile Attitude of Railroads, Both Domestic and Foreign—Studies in America and Europe to Find Remedy—Panama Canal Act—Status of Law in New York State—Characteristics of Effective Law—Same Relations Needed between Canal and Railroad as between Separate Railroads—Action by New York Necessary—Attempted Legislation—Regulating Law Passed—Analysis of Law—Rail Connections at Canal Terminals—Delay in Invoking Law.

IN OUR discussion of the terminal question and again in our consideration of the work of the Commission on Barge Canal Operation we have seen something of the need of amicable and coöperative relationships between railways and canals. The lack of such relationships had been recognized by canal men as one of the chief reasons why waterway shipping had been on the decline, but it remained for the Terminal Commission and the Commission on Operation to give authoritative public voice to the demand for a change. Indeed until the investigations of these commissions and of two nearly contemporaneous national commissions there had been no large general appreciation of how completely the railways had dominated the canal situation by their hostile actions. Finally New York State enacted a measure calculated to remedy the evil. This was in 1917 and it was brought about only after several years of hard work by canal advocates.

It will be recalled that the Terminal Commission in its final report in 1911 had recommended that "a commission composed of representatives of the leading commercial organizations in different parts of the state should investigate conditions affecting interchange of freight, the subject of prorating and through-rating, the recognition of through bills of lading and of through-rates at points of interchange, as between water and rail carriers." The answer to this recommendation, it will also be remembered, was the Commission on Barge Canal Operation, the question of rail and canal relationships being one of its main subjects of investigation. This latter commission reported to the Legislature of 1913 and made recom-

mentations for certain enactments which in general were embodied in the law of 1917. The State, however, was not entering an unexplored field in this legislation. The National government by its Interstate Commerce Act and its Panama Canal Act had led the way and New York's law was based on the Congressional acts and the Federal experience.

In reviewing the work of the two State commissions we did not discuss the subject of rail and water relationships very fully, leaving it rather for the present occasion. But a little investigation will show how important a subject it is, how, like the terminal question, it lies at the very foundation of canal success, the lack of connections and coöperative relationships with railways being sure to render ineffectual and almost useless any canal, however complete and splendidly equipped in all else that canal may be. We may see how the railroads, by operating their own boat lines and by refusing to interchange, to prorate and to through-rate freight and to recognize through bills of lading, have been able to minimize or even entirely to eliminate waterway competition. At least such is the claim of canal advocates and there seems to be abundant evidence to substantiate their assertions.

Even before the Commission on Operation had made its recommendations to the Legislature canal men were alive to their peril and had taken action which resulted in introducing two bills during the same session, aimed at the joint regulation of rail and canal rates. This action was taken by the State Waterways Association at its annual convention on September 20, 1912. Its immediate cause was a paper before the convention on "The Needs of Legislation as to the Relations between Rail and Water Carriers," by William J. Roche of Troy.

If we are to understand the situation that confronted the State and know why it eventually took the action it did, we must of necessity review the history of railroad competition with waterways and also learn what had been said on the whole subject by men who spoke with the authority of intimate acquaintance with the facts. Such a comprehensive grasp of the case Mr. Roche's paper gives us. It is made up largely of quotations from these men who spoke with authority and in addition it tells what the United States had done and what the status was in New York state. We can do no better than to avail ourselves of the compilation thus made and quote from the paper at some length.

"The Panama Canal Act and the discussions attendant upon its passage through Congress," said Mr. Roche, "have again sharply drawn attention to the relations between carriers by rail and carriers by water, and to the necessity of adopting and enforcing definite public policies concerning the two classes of carriers. . . .

"The questions have been asked: Should railroad corporations be allowed to operate boat lines? Are the State and the nation engaged in developing waterways only to have these waterways become mere adjuncts to the railroad systems? In view of the large appropriations which are being made, are we rearing and fattening waterway lambs for railroad consumption? What statutory measures are required to ensure fair treatment of the water carrier by rail carrier and the efficiency of the public waters as agencies of commerce?

"The history of transportation both in Europe and in this country tells us of the dangers of permitting the unrestricted use of waterways by railroad corporations. The past points a warning finger to the future. Railroads acquired water lines, not to put them to use for transportation purposes, but to put them out of use, and thus eliminate competition and establish monopoly. They laid hands on the choicest sites in harbors and along lakes and rivers for freight stations. They refused to issue through bills of lading when part of the route was over a water line. They cut rates on the boat lines which they controlled until their competitors sold out or were starved out. They declined to make joint rates and to prorate with water carriers. Physical connections between the railroad stations and docks where vessels received and discharged their cargoes were denied. Discriminations of various kinds, including rebating, were practiced. The result was a tremendous decline and, in some cases, the extinction of water-borne commerce. The Board of United States Engineers for Rivers and Harbors, expressing their views as to the cause of the decline of water transportation, say:

"The prevalent cause leading to the decline of water transportation is without doubt the railroad. The railroad corporation of large resources and facilities for its business successfully competes with navigation companies or individual boats with limited resources and facilities; and, competing, naturally does not enter into such relations with its competitor as to increase the business of the latter, declining to prorate, or to recognize through bills of lading. Moreover, railroads have established rival boat or barge lines through which competition has been discouraged."

"The New York Barge Canal Terminal Commission state in their report of 1911:

"The attitude toward the water carriers that has long obtained by the railroads has been one of pronounced hostility. Through transportation, that is to say, the carriage of freight originating outside of the State, has almost reached the vanishing point."

"Mr. Allen stated at the 1909 Convention of the Rivers and Harbors Congress in referring to the Mississippi River:

"Again the railroads have paralleled the river, have reduced the rates of carriage until it is impossible for boats to make a reasonable interest on their investment, and when they have gone out of business their rates have been restored or increased and railroads thus have monopolized traffic."

"At the same Convention, United States Senator Burton of Ohio said, referring to the advantages enjoyed by railroads:

"Then there is a second class of advantages that are arbitrary, due to their lowering of rates to drive waterways out of business. The best illustration with reference to that which I know, is a case where a barge line on the Mississippi was carrying freight at 25c. a hundred very profitably. The railways put down the rate to 10c. a hundred until the barge line was driven out of business; then the railroads put up the rate to 50c. a hundred, where it has remained ever since. Now, that ought not to be allowed; legislation ought to prevent anything of that kind. . . . Gentlemen, it is hardly reasonable to spend \$3,000,000 on a waterway that will not be useful, except to make a million-dollar railroad behave itself. There ought to be, in the armory of the law, something more potent, more ready than that. . . . What does the fact that railroads buy out competing water lines prove? It proves that they can afford to buy in order to get rid of a competitor. Why? Because that method of transportation is cheaper than their method of transportation."

"At the Convention of the National Rivers and Harbors Congress in 1911, Mr. Wilkinson stated:

"On the introduction of the railways, Germany passed through an experience corresponding to ours. For a long period the waterways lost their importance as a factor in the development of the commerce of the country. The Germans thought, as we have thought, that when the railways came in they could afford to neglect their waterways. In the meantime the railways secured control of the canals, harbors, and waterfronts, and either closed up waterborne traffic or raised the tariff rates for water carriage to force

transportation by rail until the cost of raw materials became so prohibitive that factories were forced to close down, throwing people out of employment, and great distress prevailed.'

"It is well known that in England, which in the earlier days was intersected by many canals, inland water transportation is in a backward condition, because the railroads acquired control of the waterways, and that acts of Parliament intended to change the situation, have had but little effect because they came too late.

"Commissioner Herbert Knox Smith says, regarding the attitude of the railroads towards water carriers:

"'Probably the greatest single deterrent to water-terminal advance is the present adverse attitude of rail lines toward independent water traffic, in their exclusive control of frontage, in refusal or neglect to co-ordinate with general water traffic, and in refusal to prorate generally with water lines in through movement of traffic. Until this underlying relation of rail to water systems is adjusted on some common sense basis of harmony, there is little hope of great advance in water terminal conditions.'

"United States Senator Bristow declared with reference to the Pacific Mail lines that they have been 'commercial pirates' run wholly in the interest of the transcontinental railroads for the purpose of using the Panama Canal in private commerce and to destroy any steamship lines that wished to establish legitimate competition with these railroads by the Isthmian route; that an absolute prohibition of the use of the canal to steamship lines, the stock of which or any part of which is owned or controlled directly or indirectly, by railroads doing a transcontinental business is necessary, and that if such a provision should not be incorporated in the bill, the canal would be of little benefit to the American people and American commerce.

"The Directors of the San Francisco Chamber of Commerce pithily said:

"'A railroad cannot honestly compete with itself, whether by means of box cars or ships.'

"The testimony on the subject is abundant and comes from authentic sources both foreign and domestic. In this country, complaints of the practices of railroad corporations in their efforts to eliminate waterway competition, have been numerous and their extent continental. There can be no better guide to the future than the lessons taught by the past, particularly when the teaching is general and prolonged. Coincident, therefore, with the commencement of

a new era of waterway development and with the expenditure of vast sums of public money for that purpose, men's minds have naturally turned to the discussion and formulation of policies that would result in securing an adequate return for the moneys thus expended, that would prevent a monopoly of transportation, that would insure the advantages of waterway competition in the movement of the products of the field, the forest, the mine and the factory and that would aid in the upbuilding of the industries of the nation.

"A review of the methods intended to accomplish these ends is pertinent.

"In his message to Congress in December, 1910, President Taft said, concerning the Panama Canal:

" 'I cannot close the reference to the canal without suggesting as a wise amendment to the Interstate Commerce Law, a provision prohibiting interstate commerce railroads from owning or controlling ships engaged in the trade through the Panama Canal. I believe such a provision may be needed to save to the people of the United States the conflicts of the competition in trade between the eastern and western seaboard which this canal was constructed to secure.'

"Commissioner Prouty of the Interstate Commerce Commission declares:

" 'If the waterways of this country are to be of substantial benefit in the way of reducing rates of transportation, it is absolutely essential that rail carriers be prohibited from owning or controlling, directly or indirectly, competing water carriers.'

"Dr. Crowl, Associate Editor of the Wall Street Journal, writes:

" 'Investors are not going to put capital into a waterway enterprise from which railway competition can drive the investor in the course of a few years. Hence, protection by law must be given against unfair competition.'

"The New York Barge Canal Terminal Commission state:

" 'Upon the Continent of Europe it should be said the railroads are either owned by the Governments outright, or they are in part so owned. The supervision of the railroads and the regulations imposed upon them by the general Government are designed to and have the effect of permitting the freest possible development of the waterways and this largely accounts for the splendid progress made in waterway and harbor improvements and in the growing commerce so notable everywhere.'

"The National Waterways Commission made an exhaustive investigation of questions relating to water transportation both in

this country and in Europe, and in their report recently presented to Congress, they say:

“‘ The lack of adequate regulations makes it possible for the railways to effectually control or to crush out water competition through their ownership and control of boat lines. It is a well-known fact that the trunk-line railways, through their control over terminals at Buffalo and their ownership of steamship companies on the Great Lakes, have been able to dominate the lake and rail package freight business between New York and Chicago and also to a considerable extent the grain traffic. On the business thus controlled the water rates have risen, while on the coal, iron and grain traffic not controlled by the railways the water rates have steadily declined. In like manner the New York, New Haven & Hartford Railroad practically dominates water transportation on Long Island Sound by reason of its ownership of the New England Navigation Company. Independent companies have been unable to compete successfully, owing to the advantage which their railway-owned competitor enjoys. The steamship companies plying between the North Atlantic and Southern ports in the coastwise trade are likewise working in harmony with the connecting and competing railways by which they are owned or controlled, so that little, if any, active competition exists. Also on some rivers the railways have acquired control of packet lines.

“‘ While this rapidly increasing control of railways over water lines tends to bring about that harmony and co-operation between them which is necessary for the development of transfer traffic, it also has possibilities of harmful results which require regulation. Where the railways grant prorating arrangements to boat lines which they own or control, while denying the same privilege to competing independent lines, the latter are practically precluded from securing any transfer traffic, while on the local or port-to-port business they must meet the competition of the railway-owned boat lines, which are at liberty on this business to cut rates to any extent they choose. Under such conditions it is very difficult for independent lines to succeed, and the cases are numerous where they have been forced to retire from the field. . . .

“‘ Sedulous care is taken by most European countries for the protection of inland water-borne traffic against railroad competition. In France this is accomplished by enforcing a differential of 20 per cent. in favor of the waterways as against railways, with the evident intention of maintaining both methods of transportation. In a

majority of the other countries in which water transportation has reached its highest development, the railroads wholly or partially belong to the State. This is true in Germany, Austria, Hungary, Holland and Belgium. The well-established policy in these countries is to secure co-operation between railways and waterways by official control of railway rates with a view to maintaining profitable traffic on the latter.'

"In an appendix to the report, I find:

" 'It may prove cheaper for a railway to control water carriers than to compete against them, especially when the natural advantages of the former are great. Thus it was the policy of railroads at one time to purchase outright or secure a controlling interest in competing canal companies. The common method in the United States now is for the railways to own or control boat lines. Where they also own the terminal facilities at a port it is a very easy matter to prevent serious competition from independents. The view was once held that the waterways were free highways on which competition would always exist, but what has transpired in the United States during the last decade indicates that even water transportation may be monopolized or so effectively controlled that it is hazardous for independent boat lines to enter the field.'

" 'The experience of all countries has been that as long as the railways were not subject to strict control, they have succeeded in crushing out or controlling water competition. The regulation of railway activities for the protection of water carriers has, accordingly, been found necessary in all countries before the normal development of water transportation could take place.'

" Guided by such experiences and recommendations, and to make certain that one of the great waterways of the world, connecting the two principal ocean highways, would be an efficient medium of commerce, free from the control of the other great force in the transportation world, Congress inserted the following provision in the Panama Canal Act, which was approved August 24, 1912, to wit:

" 'From and after the first day of July, nineteen hundred and fourteen, it shall be unlawful for any railroad company or other common carrier subject to the act to regulate commerce to own, lease, operate, control, or have any interest whatsoever (by stock ownership or otherwise, either directly, indirectly, through any holding company, or by stockholders or directors in common, or in any other manner) in any common carrier by water operated through the

Panama Canal or elsewhere with which said railroad or other carrier aforesaid does or may compete for traffic or any vessel carrying freight or passengers upon said water route or elsewhere with which said railroad or other carrier aforesaid does or may compete for traffic; and in case of the violation of this provision each day in which such violation continues shall be deemed a separate offense.'

"The act also confers upon the Interstate Commerce Commission jurisdiction to determine questions of fact as to the competition or possibility of competition, after full hearing, on the application of any railroad company or other carrier and that application may be filed for the purpose of determining whether any existing service is in violation of the section and for an order permitting the continuance of any vessels or barges already in operation. . . .

"Of course this statute relates only to interstate commerce. It does not affect the commerce which originates and terminates within the State itself, and which in a State like New York is vast in extent. Many persons are not aware of the fact that the bulk of the tonnage carried upon the Erie and Champlain Canals is intrastate. There is also the commerce of very large proportions on the Hudson River between the numerous cities along its banks, between New York and Troy. The same is true in many other States. This makes it of the highest importance that State Legislatures shall promptly proceed to declare policies and enact legislation which shall be in substantial harmony with this act of Congress; otherwise an embarrassing divergency of policies and practices will ensue.

"The Transportation Corporations Law of this State provides for the formation of navigation corporations which may operate vessels upon the seas, sounds, lakes, rivers, canals or other waters. That law contains this provision:

" 'No railroad corporation shall have, own or hold any stock in any such corporation'—meaning in any navigation corporation.

"Daniel O'Connell, the Irish lawyer and orator, boasted that he could drive a coach and four through an act of Parliament. Similarly, it will be readily seen that this statute can be made utterly ineffective. The railroad corporation need not hold the stock of the navigation company, in its own name, if it desired to control the latter. Many devices could be resorted to, in order to obtain such control. There is the familiar medium of the holding company. . . . For the purpose therefore, of making the statute effective and of keeping the waterways free from railroad control, I prepared an amendment to the existing law, and had the same introduced in

the sessions of the Legislature in 1911 and 1912; but there was no hearing on the bill. . . .

"Congress has proceeded step by step to regulate railroad traffic and extend the powers of the Interstate Commerce Commission. In 1906 authority was given to the Commission to establish through routes and joint rates as the maximum to be charged, and to prescribe the division of such rates and the terms and conditions under which through routes should be operated, and it was declared that 'this provision shall apply when one of the connecting carriers is a water-line.' In 1910, Congress undertook to check an abuse by providing that whenever a rail carrier shall, in competition with a water route, reduce the rates on the carriage of freight to or from competitive points, it shall not be permitted to increase such rates, unless after hearing by the Interstate Commerce Commission it should be found that the proposed increase arose upon changed conditions other than the elimination of water competition.

"It was seen, however, that the foregoing and like provisions would not, of themselves, sufficiently stimulate and protect water-borne traffic. Other things had to be enacted to bring about that co-ordination of water and rail lines which is essential to the development of cheap, rapid and adequate transportation. Congress undertook to provide for some of these in the Panama Canal Act as follows:

"When property may be or is transported from point to point in the United States by rail and water, through the Panama Canal or otherwise, (but not entirely within the limits of a single State) the Interstate Commerce Commission is given jurisdiction of such transportation and of the carriers, both by rail and water, (a) to establish physical connection between the lines of the rail carrier and the dock of the water carrier by directing the rail carrier to make suitable connection between the two or by directing both to co-operate in this respect, wherever such connection is reasonably practicable and the amount of business to be handled is sufficient to justify the outlay; (b) to establish through routes and maximum joint rates between and over such rail and water lines and to determine the terms and conditions under which such lines shall be operated in the handling of the traffic; (c) to establish maximum proportional rates by rail to and from the ports to which the traffic is brought or from which it is taken by the water carrier and to determine to what traffic and in connection with what vessels and upon what terms and conditions such rates shall apply.

"These are further distinct steps intended to encourage and protect transportation by water routes. Heretofore the relations, or rather the absence of relations and co-operation between the rail and water carriers have greatly tended to restrict the selection by the shipper of the route upon which he desired to send his goods and to force him to bill them by an all-rail route. They operated to retard the rapid movement of merchandise and generally to inconvenience merchants and manufacturers. The policy that prevailed was the reverse of that which was in force as to railroad lines.

"Under State law, railroad corporations are required to make physical connections with the railroads of other corporations and to afford to competing roads equal terms of accommodation and privileges in the transportation of cars, passengers, baggage and freight, and equal facilities in the interchange and use of cars; and the Public Service Commission has power to establish through routes and joint rates for the transportation of property upon railroads and to declare the portion of such rates to which each common carrier shall be entitled and the manner in which the same shall be paid and secured. All this is demanded in the public interest. The law should require as much as this from the railroads, which derive their charter from the sovereign power, in favor of the waterways built and maintained by the public moneys, and of the shippers who desire to make use of these waterways.

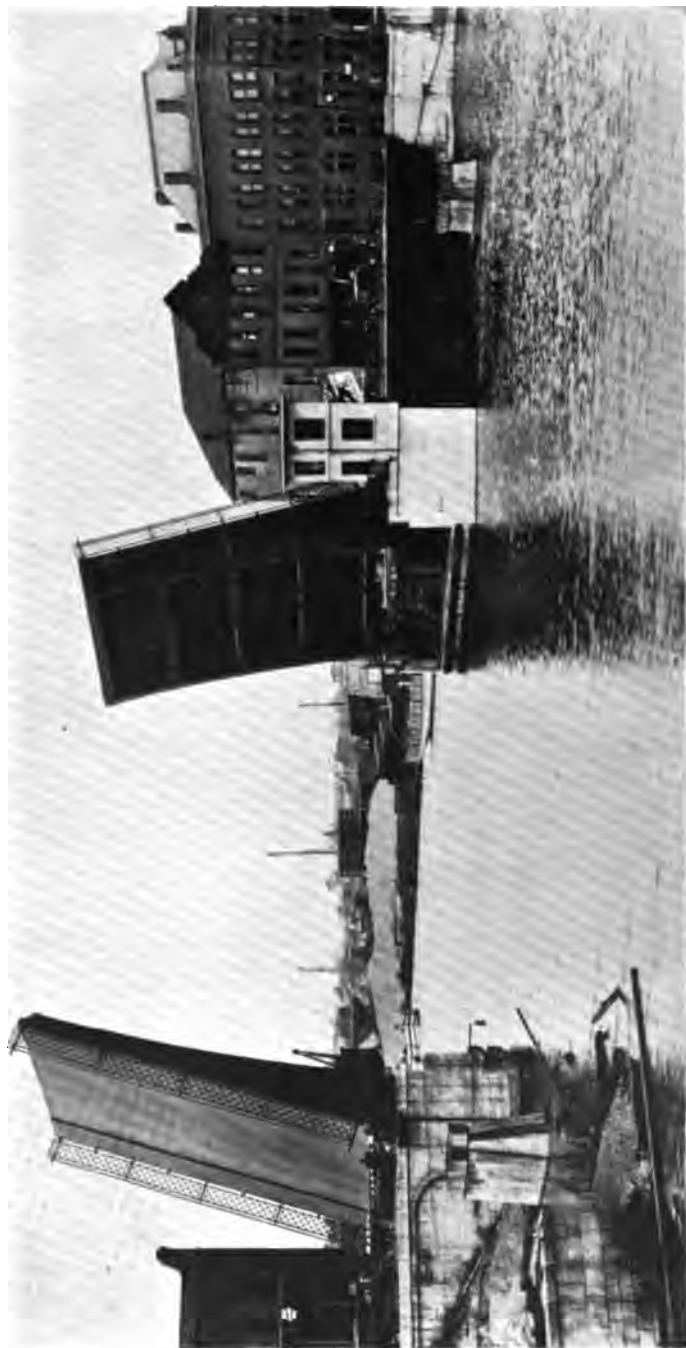
"Provisions of the kind noted, as well as one requiring the issuing of through bills of lading of merchandise shipped over both rail and water lines, should be placed in the Public Service Commission Law of this State. At the present time the Public Service Commissions have no jurisdiction or supervision over common carriers by water. This was decided by the Commission of the Second District in the case of Murray's Line against the Delaware & Hudson Company. It was also decided in that case, that the fact that a railroad company charged a shipper partly by water and partly by rail, more for transporting property between two points on the railroad than it charged for the same service when the property transported was received from a connecting railroad and carried under a joint tariff arranged by the two railroad companies, did not establish a charge of undue preference or discrimination under the law of the State. Of course the inevitable effect of such a ruling and such a condition of law is to deprive waterways of their natural advantages and to discourage transportation by such routes. . . .

"The argument is advanced that the railroads should be allowed the same use of the waterways as other corporations or as individuals, and that if abuses should develop by reason of such use, correction could be made by State or national commissions having authority in the premises. It is an old saying that 'an ounce of prevention is better than a pound of cure.' A statute which prevents an objectionable condition from arising, is much better than a state of law under which the condition may arise and then undertakes to provide a remedy for correcting the abuses which have grown up. Haling railroad corporations before Public Service Commissions is a lawsuit; it is a slow and expensive process. Many individuals would rather suffer wrongs than enter upon litigation. The true remedy, therefore, is not regulation but is exclusion.

"We know the things that have militated against transportation by waterways; it is time to move in the direction of preventing their continuance. Congress has set the pace; the State of New York should take it up. No commonwealth is more deeply concerned than the Empire State. The State has a right to limit the powers and activities of the corporations which derive their very life from the laws of the State and to regulate their relations with other corporations and with individuals carrying on business that is affected with a public interest. . . .

"Every consideration demands that one agency alone shall not be allowed to have anything approaching a monopoly of the transportation of persons and property. The merchant and manufacturer who choose to ship partly by rail and partly by water should be given the same advantages that are accorded to them when they ship their goods by connecting lines of railway. There is a splendid future before the State of New York in commercial and industrial activities, if we solve our transportation problems upon right lines. Bitter will be the disappointment of the people in waterways as economic factors, unless legislation is enacted that will keep off the overshadowing hand of the railroad and permit of the freest development of these highways."

The action of the State Waterways Association at its convention in 1912 was to appoint a committee on legislation and direct it to prepare suitable bills and endeavor to have them enacted into law. This committee consisted of Mr. Roche, chairman, George Clinton and Henry W. Hill of Buffalo, Lewis Nixon and Frank S. Gardner of New York and John D. Kernan of Utica.



Bascule bridge at Tonawanda, giving unlimited headroom. For the development of traffic on certain portions of the canal, notably at the western end, bascule bridges were permitted by amended law..



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The committee drafted two bills and had them introduced in the Legislature. The purpose of one was to make effective the Transportation Corporations Law, which, although it prohibited railroad corporations from owning stock in any navigation company, was openly or covertly violated. This bill was taken almost word for word from the Panama Canal Act. The other bill brought navigation companies and water lines under the jurisdiction of the Public Service Commission. Under the existing law they were not so included.

No hearing was given on the Senate bills and it seemed impossible for the Waterways committee to secure one. A hearing was held by the Assembly Judiciary Committee, at which the bills were opposed by attorneys for two large railroad systems. Both measures seem to have died in the reference committees. That influences powerful enough to kill them were set in motion is the belief of their sponsors. This was not an opportune session, however, for any unusual legislation. It was at this time that Governor Sulzer and the Legislature were embroiled in what proved to be mortal political combat.

During each legislative session thereafter similar bills were introduced and strenuous attempts were made by the Waterways committee to have them passed. In 1917 they achieved their end. Chapter 805 of the laws of that year was entitled "An act to amend the Public Service Commission Law in relation to common carriers by water." An analysis of this act shows that it contains ten main items. Divested of some of their legal verbiage the new provisions of the law are as follows:

After adding carriers by water to the list of common carriers subject to the supervision of the Public Service Commission, the act makes it unlawful for any common carrier to charge any greater compensation in the aggregate for transportation for a shorter than for a longer distance over the same route in the same direction, the shorter being included within the longer distance, or to charge any greater compensation as a through rate than the aggregate of the intermediate rates.

Whenever a rail carrier in competition with a water route reduces rates to competitive points, the rail carrier is not permitted to increase these rates until it has proved to the Public Service Commission that the proposed increase rests on changed conditions other than the elimination of water competition.

In all instances where competing lines of railroads or carriers by water constitute portions of a through route, the shipper shall have the right to determine over which of the competing lines his freight shall be transported. The law gives the shipper the privilege of designating over which of two or more competing routes, either rail or water, his goods shall go and makes it the duty of the initial carrier to route the shipment and issue a through bill of lading as directed by the shipper and also to transport the goods over its own line and deliver them to the connecting carrier in accordance with these instructions. It makes it incumbent also on each carrier in turn to transport and deliver the shipment as directed in the bill of lading.

The Public Service Commission has power to order carriers by rail and carriers by water to establish through routes and joint rates, and in case the companies fail to do this the Commission is to establish reasonable rates and fix the portion each carrier is to receive.

The Commission has power to establish physical connection between the lines of the rail carrier and the dock of the water carrier by directing the rail carrier to make connection with a track built from the dock, or by directing either or both carriers to make suitable connection, provided this connection is reasonably practicable and justified by the amount of business. The Commission has full authority also to determine the terms and conditions upon which these connecting tracks shall be operated and what sum shall be paid to or by either carrier, even in cases where the dock is owned by others than the carrier. The law specifically provides for rail connections at Barge canal terminals, giving the Commission authority to compel rail carriers to make connection between their tracks and these terminals, at the joint expense of the State and the rail carrier. The operation of such connections is to be in accordance with regulations prescribed by the Commission.

The Commission is empowered to establish through routes and order maximum joint rates between rail and water lines and to determine all the terms and conditions under which such a line shall be operated.

The Commission has authority also to establish maximum proportional rates by rail to and from places to which traffic is brought or from which it is taken by the water carrier and to determine to what traffic and upon what terms such rates shall apply.

If any rail carrier enters into arrangements with any water carrier for the handling of business, the Commission may require such carrier to enter into similar arrangements with any or all other common carriers by water.

No common carrier by rail shall own or have any interest whatsoever, either directly or indirectly, in any manner, in any common carrier by water with which it does or may compete for traffic, or in boats carrying freight upon any water route with which the rail carrier competes. The Commission is given jurisdiction to determine questions of fact as to competition or the possibility of competition, after a full hearing. For determining these questions proceedings may be instituted, either upon application of a carrier or at the volition of the Commission. The status of existing service in regard to this provision may be inquired into and application for new service not in conflict with the provision may be filed.

The requirements of the General Public Service Commissions Law in regard to the filing, the publication and the changes of rates and charges by common carriers are extended to include rail and water carriers on a through route which is partly by rail and partly by water. This provision, however, does not apply to shipments which are wholly by water and are independent of any railroad service.

Such in general are the provisions of the amendment. It applies of course only to intrastate traffic; the Interstate Commerce Commission has jurisdiction over traffic passing from one state into another. It will be noticed that a section prohibiting ownership or control of boats by railroad companies is contained in this law. This section accomplishes what was proposed in 1913 in the attempt to change the Transportation Corporations Law.

In the working out of a portion of this law some difficulty has been encountered. At most places where the railroad companies have been asked to make connections with canal terminals and interchange freight the request has met with compliance, but at Erie basin, Buffalo, the New York Central railroad company, with whose tracks the terminal is connected, refused to perform a switching service between the terminal and industries located on its tracks in Buffalo or with industries situated on the tracks of other railroad lines in Buffalo with which the New York Central connects. The Superintendent of Public Works, therefore, filed a complaint against the railroad with the Public Service Commission, alleging

a violation of the law and asking for an order from the Commission to compel the company to perform the service demanded. The Commission decided in favor of the State, but the railroad disputed the authority of the Commission and in effect refused to comply with its order. The matter was taken to court and the decision rendered was that the Public Service Commission was without power to act. The case has been appealed.

Interchange facilities between railroads and the Barge canal now exist at Buffalo, Rochester, Syracuse, Utica, Schenectady, Troy, Albany and Oswego; also on the Hudson river at Hudson and Beacon.

It is possible now by a combination of Barge canal and lake lines to get through rates, through bills of lading and like privileges for inland ports, but any appreciable degree of coöperation between the canal and the railroads is still lacking. Although the machinery of the law has been provided for securing this coöperation, it has not yet been set in motion. The reason is that canal operators think it much better, even if slower, to secure this end by amicable means than by force. Moreover the operators are not in a position to make any demands for interchange with railroads. Their shipping is so meager that all available boats are required to carry between the Great Lakes and the Atlantic seaboard the bulk cargoes that pass over the Lakes in steamers or barges. There is another strong reason for not invoking the law, particularly the Federal law. Questions concerning interstate traffic come before the Interstate Commerce Commission and any appeal to this body is considered most inadvisable. In the first place it would be the opening wedge toward giving the commission jurisdiction over Barge canal carriers and thus restoring such conditions as prevailed during the United States control of the canal. No well-wisher of the waterway desires a repetition of that experience. Also it is believed that the commission is unfriendly toward canals, the majority of its members being men with railway proclivities. What the operators plan to do is to demonstrate to both the shippers and the railways that service by the canal is just as reliable as is that by rail. They have established minimum canal rates; they give through bills of lading, grant insurance on all water-borne freight and extend other facilities which greatly improve the service they now offer. They expect that when the service is perfected and the fact becomes widely known public opinion will demand and secure a coördination of rail and water carriers.

CHAPTER XVIII

THE CANAL IN OPERATION

Opening of Canal a Gradual Process—Hindrances to Quicker and Fuller Use—Officials Deprecate Condition—Superintendent's Opinion as to Qualifications of Efficient Carriers—Steady Decline in Canal Traffic Arrested in 1917—New Commodities Carried in This Year—Government Control Discourages Canal Traffic in 1918—Business Corporations and War Craft Use Canal—Decline in Traffic Turned to Increase in 1919—Government Activities Lessened—Several Encouraging Features—Superintendent Sees Bright Prospect—Business Conditions Affect Traffic Adversely in 1920—New Common Carriers—New Private Operators—Oil Company Prominent in Use of Canal—New Prospects—Ability to Carry Perishable Products Shown—Traffic Increased in 1921—Combined Lake and Canal Boat Appears—Package Service Inaugurated in Small Way—Plans to Use Canal During Railroad Strike—Promising Association Formed to Promote Canal Use—New Type of Boat—Example of the Manchester Ship Canal.

WHEN the State decided to build the Barge canal the authorizing law required, by implication at least, that the canals should be kept open for navigation during the major portion of the usual season all through the years of construction. The opening of the new waterway to navigation, therefore, has been a gradual process, one of adding new sections of enlarged channel piece by piece to a canal already in full operation. Accordingly it is not possible to point to any definite date as the beginning of Barge canal traffic. Of course there came a day, May 15, 1918, when the canal through its whole length could pass boats of full Barge canal dimensions, but for a year or two prior to that time such commerce as does not need the whole extent of the canal for its accommodation had been plying on the new waterway in enlarged craft.

In discussing the commerce on the Barge canal the negative features, if the term may be used, loom larger than the positive. Moreover the recital appears less like a history than an explanation, so many untoward situations have arisen to hinder the building up of canal traffic. Up to the time when considerable portions of the enlarged waterway were opened to traffic, affairs in general had been proceeding according to expectation. It was known that there were not many really good boats in service at the beginning of new canal construction nor many indeed of mediocre or even poorer

quality. The unsettled canal policy of the preceding years had not conduced to any other condition. And no one wondered that after another decade these few boats had become still fewer or that dilapidation and unseaworthiness were fast overtaking them all. Nor was it anticipated that new boats would be built until shortly before the completion of the entire canal project. But just as the time was approaching when boat-builders should get busy, the unlooked-for, the almost unbelievable happened. Boat construction for the canal became impossible because the whole world was at war. This impossibility in turn was followed by a series of events as unfavorable as they were unexpected.

Thus it is that we find the State canal officials deprecating both the lack of boats and the inability of builders to increase the number. In 1915 a considerable portion of the new canal was open to traffic, but by that time costs had reached such a height as to make boat-building, and every other form of construction for that matter, almost prohibitive. And after the United States entered the war, what had been impracticable because of excessive cost became virtually impossible because of inability to secure labor and materials at any price. When peace was restored costs were slow to come down and moreover the Federal authorities retained control of the State canals and private capital would not enter the field in competition. And so, after these several years since the canal was completed, the building up of canal traffic can be said to have only just begun.

But there have been other obstructions and other causes of delay. During the years of new construction the canals, of course, could make no strong appeal to shippers and traffic more and more sought other channels. The railroads were alive to the opportunity and succeeded in turning most of it to their lines. Once diverted it was hard to regain. The old shippers had to be won back and the new generation which had sprung up had to be educated. Then for some unaccountable reason, ignorance it may be, there has been a prejudice against the canals and this has had to be overcome. There has been, too, a wide-spread belief that the canals are suited to carry only a very few kinds of bulky cargo and that passage through them is so slow as to render them almost useless for modern times. Two other barriers, perhaps the most insuperable, and they go hand in hand, are the lack of sufficient transportation companies capable of maintaining a far-reaching, dependable and efficient freight service and the further lack of through routes, through rates, railroad interchange, prorates, through bills of lading and the other privileges accorded by rail carriers.

Reference is made to these hindrances and delays, not by way of apology, but because knowledge of them is necessary to an understanding of canal commerce. Furthermore this subject is so closely allied to the topics discussed in the preceding three chapters that the four must be read virtually as one.

In our further study of canal traffic let us consider for a moment what the two chief canal officials had to say in regard to commerce on the canal soon after any considerable portion was opened by navigation. Their comments will serve to confirm and to amplify what has just been said. In his annual report for 1917, presented to the Legislature of 1918, State Engineer Williams said:

"During the past year much has been said in the public press as to the lack of boats suitable for use on the new canal. It is true that such a condition exists. There are practically no boats of a type suited for efficient operation on the new system and few, if any, are in course of construction. When the canal was planned, it was assumed that the boats to operate in its channel would be provided by private capital, and such was the logical conclusion to draw. The war, however, has entirely changed this aspect of the situation, and without definite assurances from the Federal Government that it will coöperate, it seems very doubtful if capital can be attracted to this field until peace returns. This is not surprising, inasmuch as capital cannot now be induced to take up any new transportation scheme unless the Government renders assistance. The unfortunate condition exists, however, that if a decision to help is not speedily arrived at, this splendid canal will not be permitted to play its part as a war resource this coming navigation season, not because it will not be open for navigation, but because there will be practically no equipment to float upon it."

In speaking of the advisability of use being made of the Barge canal by the Federal government, Superintendent of Public Works Wotherspoon had the following to say in his annual report of 1917. Incidentally it throws light on the subject of canal speed.

"Failure to make use of a waterway possessing all the physical and economical elements required for success, and paralleling the railroad routes, would be looked upon by the future historian as an inexcusable blunder. Whether the canals be used for the carrying of materials and supplies for the armies abroad, or whether they will serve the general business interests of the country, the benefits are the same.

"If economy in freight movement is desired, the canals will supply it. If a prompt and speedy receipt of freight is demanded, the waterway at the present time excels the railroads. Whatever may have been the performance of the railroads in other times, it is a matter that may be proved beyond doubt that cargoes by canal pass from Buffalo to New York in less time than by rail. Already, with a portion of the old canal in use and by means of antiquated canal boats, a fleet has made the trip from the Great Lakes to New York in a little more than seven days. With the new canal route in use for its entire length, five days may be counted as the maximum time of passage.

"To secure a test of comparison, inquiry was made as to the time consumed by the railroads in carrying freight between Buffalo and New York City. Records were sought regarding some half dozen cars. The tracing of one car showed that it was 23 days in transit and the least time taken by any car followed was eight days. Taking the six cars as a whole, the average time consumed by a car in making the trip from Buffalo to New York was 11 days. Arguments, therefore, against water transportation on the ground of slow delivery, are treated with impatience."

In this same report General Wotherspoon gave his opinion of what should be the qualifications of an efficient canal carrier. He said:

"The new waterways of this State constitute a great system. If the people are to receive the benefits had in mind when the project was approved, operations upon it must be conducted in a large way. While some business will await the individual boat-owner, his efforts alone cannot avail in restoring commerce to the canals in sufficient amount to justify their maintenance.

"In the development and transaction of ordinary business, a high degree of efficiency has been reached and the worth of those engaged in operating on the canal will be measured by the same standards. The splendid waterways about to be thrown open for use present a wide field for the activities of energetic, enterprising men who are capable of maintaining a dependable freight service. The organization of an operating company must be equal in efficiency to that of a railroad and the personnel of the management must be such as to command the confidence and respect of the shipping public. The shipper may not be expected to entrust merchandise of high value to a carrier whose ability either to make delivery as required, or render reparation in case of failure, is not assured. As a matter of fact,

the development of canal commerce depends entirely upon the nature of the service rendered. Service not only embraces frequent and regular sailings but also all of the incidental features demanded by the shipper.

"The traffic available for canal transportation moves to and from practically every section of the country. Its first demand is for through routes and through rates. To care for it, canal lines must serve as broad a territory as the competing railroads. They must prorate and interchange traffic with connecting water or rail lines, giving shippers a through bill of lading, with the privilege of specifying through routes, and assume all of the liabilities and conditions of carriage incurred by rail carriers. The rates of the canal companies must be on a fixed basis, published in tariff form, and should include marine insurance. In other words, the companies which shall operate on the new canal should be worthy of the splendid plant placed at their disposal."

We saw in the chapter on Federal control that the year 1918, the first year the Barge canal was open throughout its entire length, was not favorable for private use of the new waterway. Nevertheless General Wotherspoon in commenting on the traffic of this year says that one who studies the record and analyzes the freight movement "can take no discouragement from the results attained, in spite of the fact that the total tonnage fell below the 1917 business by 137,955 tons. He cannot fail to be impressed with the many indications of the rehabilitation of the canals as a commercial factor."

The steady annual decrease of more than fifteen per cent yearly for the preceding ten years was arrested, the Superintendent went on to say, and although the decline was not turned into an increase it was limited to nine per cent. Except for extraordinary conditions, due to the war, it was believed that the 1917 tonnage would have been exceeded. The decrease appeared to be in west-bound traffic, which was accounted for by war conditions, and there was a favorable omen in the increased proportion of through freight. Moreover the canals were not alone in their experience. The record of business done by Great Lakes and Hudson river boat lines disclosed a similar situation. In this year for the first time modern transportation practices were in operation in the stabilizing of rates by publication in tariff form and in the maintenance of a traffic organization having responsible authorities guaranteeing its activities.

Also the efficiency of the canal as a carrier of high class freight was demonstrated. There were certain commodities which were new on the list of canal cargoes or which had not appeared on that list for several years. Among these were gasoline, kerosene and other oils, molasses, coffee, copper, and electrical machinery, apparatus and supplies. Flour too was shipped in considerable quantity for the first time in many years. War orders of knit goods were also shipped by canal. At two Barge canal terminals it was found necessary to build additional warehouses because of the large volume of traffic.

It was in 1917, it will be recalled, that a traffic bureau had been established in the department of the Superintendent of Public Works. During its second year it had been able to reach out into wider fields. For one thing a study had been made of the possibility of shipping coal by canal and the conclusion was reached that in the use of the new waterway lay the solution of the fuel distributing problem for much of New York state territory and even a part of Canada. Early in 1918 the Superintendent presented his plan for coal distribution to the Federal authorities, but the suggestion ended with a partial survey of the situation by Government engineers.

The freight rates that prevailed during 1918 did not favor canal traffic. The United States was in control of the waterways and the parity of rail and canal tariffs at first in force and the later small differential militated against any large use of the canal, even if boats had been available. In the preceding year the State had made provision for coöperative rates between rail and water carriers, but its authority stopped at the State boundaries and moreover canal men did not attempt to have the new law enforced. Accordingly, with the exception of through rates between New York city and some western points by way of the canal and the Great Lakes, there was no coöperation between the various carriers. In spite of repeated urging that it was necessary to establish through rates by all practicable routes between producing and consuming areas tributary to the waterway, in order to broaden the spheres of usefulness and influence of the canal, the Federal government did nothing, although it had acknowledged the wisdom of adopting such a course by the general policy it had followed in other parts of the country.

One gratifying aspect of canal traffic was the use made of the waterway by several large business corporations, which operated

their own boats for carrying their own raw materials or manufactured products. Two companies to enter this field in 1918 are among the largest business concerns in the country. A somewhat incidental but a very important use of the Barge canal in both 1917 and 1918 was that made, chiefly by the United States, for the passage of war and other craft built at inland shipyards, such as submarine chasers, mine layers, mine sweepers and steel trawlers, or such as car ferries, floats and tugboats or an occasional large boat, which was being transferred from lakes to ocean service.

When we review the traffic on the canals for 1919 we find that this year turned the tide of decrease that had been going on for a decade or more into an actual increase. It exceeded the tonnage of 1918 by about seven per cent and the increase on the Erie branch was about twenty-five per cent. In our consideration of Federal control it was shown how the Railroad Administration had agreed to lessen its activities in several particulars during this year. The beneficial effect was obvious even in the face of the continued menace of Government operation. A most important concession was gained in the establishment of certain through rates to the west. For the first time in the history of the canals shippers in New England were enabled to utilize the New York canal route to western territory on a differential rate basis. Also there was an encouraging prospect in the activity manifested by several industrial corporations, some of them of national repute, in seeking manufacturing and warehouse sites along the new waterway. In reporting on the navigation of the year the Superintendent of Public Works gave an interesting incident. He said that a fleet composed of boats of the old type made the trip from seaboard to Lake Erie in four and two-thirds days, a record never before achieved.

In his annual report for 1920 Superintendent of Public Works Walsh said:

"The years 1918, 1919 and 1920 have marked the turning point in canal traffic. An average annual decrease of approximately 15% was arrested in 1918 and but a 9% decrease was shown that year. The season of 1919 produced an increase of 7% over the preceding year and 1920 surpassed the 1919 record by 15%. In a sense, therefore, the total gain since the new waterway came into use is about 30%, and with this start, accomplished during a period of the Nation's history fraught with difficulties and obstacles that were not easily overcome, I predict a constantly increasing annual

traffic. In my judgment the next five years will witness the restoration of a water-borne commerce through the State between the Niagara Frontier and tidewater that will eclipse even the wonderful achievement of the original Erie Canal. Inland waterway transportation generally is coming into more and more favorable regard throughout the country. The shipping public is returning to first principles. The transportation instrumentalities that contributed more than any other factor to the building up of the country in the early days—the natural water courses—have again come to be considered by straight thinking men as invaluable assets and facilities deserving of utilization and development. An unwavering policy of modernizing these facilities on the part of Federal and State Governments offers, in my opinion, the final solution of our great transportation problem.”

It should be remembered that these are the words of a man who has spent his life in the transportation business, chiefly on the State waterways.

At its beginning the year 1920 bade fair to show a much greater increase in canal traffic than the figures for the whole year actually recorded. For the first month the traffic was double that of the preceding year, but later there came adverse conditions. A general business depression curtailed production and there was much less to be shipped, by either rail or water. What little building there was almost ceased. Also there was decreased production at the coal mines. The grain business, although there were bumper crops, was disappointing. An acute car shortage in the grain country held back the movement till almost the close of the navigation season. Also a sharp decline in the grain market made those who had bought at a high figure more anxious for a quick delivery that would enable them to turn over their capital with a minimum of loss than for saving a few cents a bushel in carrying charges, and this turned the traffic away from the canal. But of greater effect were the preferential grain rates between the Missouri river territory and the Gulf ports. The largest surplus of domestic exportable grain was in Kansas and Nebraska and ordinarily the bulk of this commerce would have moved by rail and lake through Chicago or Milwaukee to Buffalo and there have been available for canal traffic. But a maladjustment of rates, as the Superintendent of Public Works termed it, favored the all-rail route to the south and diverted most of the Missouri river crop from the usual rail-lake-Atlantic route to the Gulf ports. In this experience the Superin-

tendent saw a very grave menace to the prosperity of the ports not alone of Buffalo and New York but of Boston, Baltimore and Philadelphia as well. It was a subject, he considered, which demanded the most careful attention and possibly litigation before the Interstate Commerce Commission.

The year 1920 witnessed the entrance of four new transportation companies in the common carrier service on the canal; also the large expansion of another and the broadening of the scope of service of a sixth. Among the four new companies was one which promised to be the foremost canal carrier. Back of it was a corporation formed primarily for ocean service and the canal activity was supplemental to its ocean business. The permanence of the operations of this company as well as the efficiency of its service was guaranteed by the substantial character of its members. Its entrance into canal transportation was the first evidence of big business recognizing the opportunities for profitable operation offered by the new waterway and so it was most gladly welcomed by shipping interests.

The year 1920 witnessed also several newcomers among the industrial concerns operating their own boats on the canal. The most active of the private operators, the Standard Oil Company of New York, calls for special notice of its canal business. It was one of the first to use the new canal and in 1920 its fleet had grown to nine tank barges, each having a capacity of nearly 200,000 gallons, and these were in constant service. From a distributing base on the Hudson river at Albany cargoes were carried to cities and villages situated on all of the four enlarged canals, the company having acquired property adjacent to the waterways and having erected large storage tanks on the shores. At Rochester in 1920 the company spent more than \$100,000 in providing a harbor and docking facilities for its barges and its investment in property and terminals along the State canals, together with its canal floating equipment, ran into the millions of dollars. During the 1920 season these barges had a mileage record of 29,316 miles and they carried 94,862 tons of petroleum products. It is said that during the season the company did not ship one carload by rail to such of its stations as had both rail and canal connections, all of the supply going by water. Moreover the company had under construction five self-propelled tankers, each of 700 tons capacity, which it was building for the next season. "I accept the interest and operations of this huge corporation," said the Superintendent of Public Works, "as final proof of the efficiency

of the new canal system. Sagacious in the extreme the corporation early made preparation for an extensive utilization of the Barge Canal System, even before the new waterway assumed completed proportions, and the annually increasing volume of tonnage carried through the canals by its tank barges gives conclusive answer to those who question the economy of canal shipping."

The prospect opened by the 1920 season was bright. New sources of traffic were being developed. Among these was imported flaxseed, 81,465 tons being carried from New York to Buffalo. With the completion of the grain elevator at New York an increase in this commodity was expected. A large corporation owning great tracts of timber land in Canada established a pulpwood distributing terminal on the canal at Oswego. Maine pulpwood companies were getting ready to ship over the canal many thousand tons of their wood. The location of an internationally famous rubber manufacturing concern at Buffalo presented the prospect of carrying by canal crude rubber and other imported raw materials. A large power-developing company in the lower Mohawk region was planning to bring by canal the 75,000 tons or more of coal it would need each year.

The season of 1920 also demonstrated the value of the canal as a carrier of other than low grade and coarse freights. Many barge loads of perishable commodities, such as potatoes, apples and onions, were handled, so that even the development of a refrigerator barge was considered. A peculiar but interesting instance of perishable freight was a cargo of live eels. This shipment, originating at Quebec and carried in four specially constructed barges, entered the canal at Oswego and was speedily transported to the New York market. This unusual venture was so successful that its promoter arranged for building other boats, planning to carry on a regular traffic in eels the next year.

Speaking of the possibilities of future canal business, Superintendent Walsh, in his annual report for the year 1920, said:

"There is no commodity produced or consumed throughout the territory traversed or connected by the waterway that is not potential canal freight. Everything that is transported by rail lines can be safely and economically carried in canal service. A tremendous volume of tonnage awaits the inauguration of a high class transportation service on the waterway and, with the creation of such service, the success of the undertaking will be assured."

The traffic on the canals in 1921 showed an increase over that of the preceding year. In some respects this increase was quite marked. The grain trade increased more than two hundred per cent and was limited only by the number of boats available. The record for the year was 13,736,010 bushels, or 365,990 tons. Among other commodities the large shipments of building brick were noteworthy. Considerable quantities of phosphate rock, nitrate of soda and crude sulphur were sent from Florida to Trenton, Ontario. The rates quoted the shippers on these latter materials were for transportation from the mines to the final destination, including the ocean passage, and it is said that the water route effected a saving of \$2.50 per ton compared with rail rates. The sending of automobiles by canal had become so common as to have lost its novelty. Begun a year before because of a scarcity of railroad cars, it had been continued because shippers appreciated the advantage the canal gave in a saving of both time and money. There were certain commodities which showed reduced shipments in 1921, but in nearly every instance the decrease simply reflected the business depression of the period.

A new type of vessel made its appearance on the canal in 1921, a boat used for combined lake and canal service, although it was intended originally only for canal use. There were five of these vessels and the first to traverse the canal carried a cargo of 83,000 bushels of oats (1,328 tons) from the head of the Lakes to the ocean. The boats measured 242.6 feet by 36.1 feet, thus filling the canal locks well toward their full capacity, and were designed to carry 1,500 tons on a ten-foot and 1,750 tons on an eleven-foot draft. The greatest load any of them carried during the season was a little over 1,600 tons. Each boat was equipped with two 140-horsepower semi-Diesel oil engines and twin screws. This fleet was an important innovation, which in a way promised much for the Barge canal. Still it attempted to do something that was not contemplated when the Barge canal was begun, namely, to combine equally successful and economical navigation of both the lakes and the canal in a single boat. The record of the fleet has not yet proved that such a thing can be done.

The boats owned by corporations and used for shipping their own products continued in successful operation. The most conspicuous example, the Standard Oil Company, placed in service the five power cargo barges it had been building the year before and also some other new barges. This company's boats had a total mileage in 1921 of 60,326 miles and a record of transporting 39,016,063 gallons of oil products, or a tonnage of 128,754 tons.

A package service was inaugurated in a small way during the year and this gave promise of growing into something that would fill a long-felt need. Superintendent Cadle mentioned this in his annual report as a favorable indication. A service of this kind would have to be quick in order to succeed and there was a wide field for exploitation, in such cargoes for example as shipments to upstate markets of fruit received at New York by water from California or the South. The canal had been used to some extent for carrying home-grown apples, potatoes and onions, but its advantages for such purpose were as yet not well appreciated. A package service would help in this respect. Pacific coast lumber, coming by water through the Panama canal, continued to be reshipped through the Barge canal and the prospect was good for increased traffic in this material.

The Superintendent appointed a publicity agent in 1921 and considerable was done by way of spreading information concerning the canal through this new channel. Press articles, public meetings, lectures at colleges and schools and motion pictures were the tools in this educational campaign.

The canal was kept open till December 25, 1921, a record without precedent in any recent years.

In October of this year it seemed for a time very probable that there would be a strike which would tie up all the railroads of the land. That the people of the state might suffer as little as possible from such an occurrence Governor Miller took steps so to organize shipping by canal and highway that all needs would be met. The Governor appointed a special emergency committee, of which the Superintendent of Public Works was chairman and the Commissioner of Highways, the Commissioner of Farms and Markets, the Adjutant-General and the Superintendent of State Police were the other members. Forty-eight hours after its appointment this committee had perfected an organization which, it was felt, would be sufficient for the emergency. The strike, however, was averted and the need for using the canals and highways as the sole means of transportation passed. Nevertheless there was comfort to the citizens in the feeling that there were at hand means for preventing such a calamity as was threatened. In this connection a most pertinent query presents itself: If the canals are so valuable in an emergency, why not recognize their value for ordinary occasions, why not use them to their capacity all the time?

The year 1921 witnessed the formation of an organization which should go far in bringing such measure of success to the Barge



Example of many canal structures in close proximity—at Lyons. At the left a terminal with a frame warehouse; in the distance a lock, two Taintor gates, a spillway, a power-house, a highway bridge and an electric railway bridge. The boats are of modern type, built expressly for Barge canal traffic.



canal as it deserves. This organization seems to be founded on the right principle, that of securing for waterways what is absolutely essential, if they are to succeed, and doing it by the most practical and reasonable means. The organization is named The Great Lakes, Hudson and Atlantic Waterways Association, Inc. It was formed at Albany on March 16 and held its first convention in Buffalo on June 29, 1921. The personnel of the Association and the purpose for which it was established as well as what it has already done give promise that it will meet the real needs of adopting some definite plan to make our inland waterways fulfill their mission as transportation routes and of bringing ocean facilities to the inland shipper. The Association does not favor any particular waterway, but came together in full appreciation of the fact that the time had arrived when selfish and partisan ends should be put aside and all believers in waterways should stand together and by united effort secure the benefits that may be expected to follow a full and intelligent use of all water routes. The organization is lending its influence toward the establishment of uniform rates on barge lines operating between the Great Lakes and the Hudson, the maintenance of regular schedules, the preparation of official classifications of freights and the issuance of through bills of lading from inland cities to foreign ports. In a word, it is undertaking the task of bringing ocean transportation facilities to the inland shipper by applying the principles which govern the operation of ocean vessels to the inland water carrier. Since the Association is made up largely of men engaged in the business of transportation, such aims as it professes seem certain of effecting beneficial results. A phrase used at the meetings of the organization aptly defines its task—to make the public canal-minded. This task, to borrow another phrase, one from a speaker at the first convention, is to do what the old proverb declares to be impossible—not only to lead the public to water, but also to make it drink, or, in traffic language, to make it use the canal.

A very important requisite to canal success is complete coöperation between rail and water carriers. As explained elsewhere this desideratum has not yet been secured for the Barge canal, but the operators think they can accomplish more by amicable relations with the railroads than by forcing them to do something against their will and so the law has not been invoked to right what appears to most persons to be a grave injustice against the public.

It may be that a recent boat design will do more to bring commerce to the canal than anything that has gone before. The new

design uses in part the principle of the speed boat known as a sea-sled, but the craft is more like a catamaran. Its chief virtue is the high rate of speed without washing the banks. To make the curves at high speed a special steering device is necessary. A certain type of racing boat has a rudder forward as well as aft; the new canal boat secures the same result by an arrangement of pontoons. Canal boats already make better time than the average rail shipment. If the new design can reduce this time materially, the canal will have a most signal advantage over the railways.

This chapter, because its subject deals with a period of transition and growth, cannot be finished. The building up of traffic on the new canal has begun and recent developments have made the prospect look bright, but much still remains to be accomplished. It is probable that people in general have very little idea how stupendous, under conditions as they now exist, is the task of bringing to the canal the volume of traffic which it is capable of handling and which, in the opinion of waterway advocates, it should handle, both right-fully and to the benefit of the State and its citizens. What the general manager of the Manchester ship canal said concerning the development of commerce on that waterway will help us to understand why we should not yet expect the Barge canal to have attained a large amount of success. We quote a paragraph from the report of the Commission on Barge Canal Operation, which contains this statement.

"A practical example of what organization means," said the Commission, "is to be found in the management of the Manchester canal, Manchester, England. This being a ship canal it is generally dismissed from consideration when internal waterways are under discussion. Though this waterway was intended for ocean-going ships, no more practical lesson has ever been taught than is contained in the history of and the results already attained on this canal. The enterprise was undertaken and carried through by private capital, and though the thousands of stockholders have as yet received no return in the way of direct dividends, the original investment has been returned many fold in the way of increased values and expansion of industry. A city which is said to have been on the verge of extinction as a city of importance has been redeemed and nearly doubled in population in less than twenty years, and the prosperity of a territory within a radius of forty miles has been permanently assured. A reduction in rates for delivery on all classes of goods from 40 to 80 per cent. has insured universal participation in the

benefits. This, too, has been accomplished without detriment to Liverpool, to which Manchester and vicinity previously paid heavy tribute, for Liverpool's growth and expansion have kept pace with those of Manchester. How this has been accomplished is best summarized by Mr. Herbert L. Gibson, General Manager of the Manchester Ship Canal: 'The struggle of carrying the bill, authorizing the construction of the canal, through Parliament, was strenuous and exhausting. The engineering feats were executed in a manner to excite the admiration of visitors from all parts of the world; but great as have been the efforts put forth in these directions, they were nothing to the tremendous task of diverting traffic from beaten tracks to this new route. *This has been done only through organization and the employment of trained experts.* In spite of all that has been accomplished we feel that as yet we have only touched the fringe of a commerce which will ultimately go to Manchester.' "

CHAPTER XIX

ATTEMPTS TO ADD OTHER BRANCHES

Desire to Share in Original Canal Benefits—Like Desire to Share in Barge Canal Benefits—Black River Canal Extension: History of Building Black River Canal: Early Arguments: Previous Agitation for Extension: Recent Agitation: Surveys and Estimates: Attempted Authorization: Repairs to Existing Canal—Chemung Canal Reconstruction: Effect of Revolutionary Expedition: State Canal Built: Vicissitudes of Waterway: Private Canal Built: Both Parts Abandoned: Recent Survey and Estimate—Glens Falls Feeder Conversion: Topography and History: Retained as Barge Canal Feeder: Survey and Estimates: Discussion of Expediency—Jamaica Bay-Flushing Bay Canal: Topography: Influence of Jamaica Bay Terminal Agitation: Route and Three Types of Canal Discussed: Estimates: Benefits Claimed—Newtown Creek-Flushing Bay Canal: Route: Estimate: Benefits Claimed—Summary of 1913 Estimates—Barge Canal Branch, Seneca River to Auburn: Route: Estimate: Analysis of Cost of Carriage—Improvement, Tonawanda to Buffalo: Navigation against Current Involved: Investigation Conducted: Report against Project: Estimates—Some Principles Governing Canal Economics.

IT HAS been true of most great movements that they have engendered a spirit of emulation. And when these movements have had large promise of beneficence, this spirit has been augmented by the stimulus of a strong desire to share in the benefits. Thus in the case of our own canal, the original Erie, the great pioneer of American waterways, its completion and early success was followed by a veritable frenzy for canal-building throughout the country. In New York state this zeal manifested itself in a flood of petitions to the Legislature for the opening of waterways, in the surveys of hundreds of miles of proposed routes and the building of several lateral canals and in the incorporation of more than sixty private canal companies. One act alone, what is known as the "great canal law" of 1825, ordered the surveys of seventeen contemplated canals, covering a distance of over twelve hundred miles. Within the first decade after the opening of the Erie and Champlain canals six more State canals were built and during the next four years still four others were authorized.

So again, to share in the promised good of the Barge canal, the people of several sections of the state have sought and obtained

surveys and investigations of various routes along which they have desired to have built additional branches to the new canal system. On none of these projects, however, has the agitation passed beyond this preliminary stage and the reason for this is not hard to find. Primarily the need for waterway enlargement to Barge canal dimensions was felt for the Erie canal alone, but before the improvement of that branch was authorized two other canals were included in the scheme, and this was done, as we have seen, partly for the purpose of securing united support for the whole canal movement. Then a few years later a fourth branch was added, so that now the four main State canals, the four that on previous occasions had been deemed worth enlarging, have been increased to uniform Barge canal dimensions. Although these other examinations, which we are about to consider, have been made and in some cases careful surveys and estimates and tentative plans have been added, there has not existed sufficient public demand to push any of them to the point of very serious consideration. Doubtless our experience with our abandoned lateral canals has taught us caution, and also there seems to be abroad a better appreciation of the principle now generally recognized by those conversant with the subject, that waterways which do not connect large industrial centers nor reach the source of some extended natural supply are not worthy of construction.

We would not say, however, that any of the proposed routes which the State has ordered to be examined within the past few years should be rejected because of adverse decision under the principle just enunciated. That is not a question for us to determine. Perhaps the days to come may see canals built with profit along some of these lines. But historically these investigations are of interest to us, irrespective of any future prospects, and we shall study each in turn with some care. Also, outside the borders of New York state but connected more or less directly with the Barge canal system there have been proposed other important canal projects. A little later these too will engage our attention, but for the present we shall confine our thought to our own particular schemes.

BLACK RIVER CANAL EXTENSION

The first of the projects to receive legislative authority for investigation was that along the course of the Black river from Carthage to Lake Ontario. In 1911 the Legislature (by chapter 190) directed the State Engineer to make a survey and prepare plans and estimates for improving the Black river for navigation

between the State dam at Carthage and Sacketts Harbor, on Lake Ontario. To understand this project we need to know a little of what has gone before in this region.

The story of the attempts to provide waterways for this North country, the failures as well as the successes, is most interesting. Like other branches of the State system the career of the Black River canal and its adjuncts has been rather checkered. First came the incorporation of the Black River Navigation Company. In 1810 this body was given power to improve the river from Lake Ontario to Brownville, a village lying some four or five miles up the river. It is recorded in the annals of Jefferson county that this company built the necessary wooden locks at Dexter, near the lake, and that later, in 1828, these were rebuilt of stone to accommodate a steamer named "Brownville," which had a length of 80 feet, a beam of 20 feet, a hold depth of 6½ feet, a capacity of 100 tons and engines of 35 to 40 horse-power, and was built in the village of Brownville. It was the intent to use this vessel for traffic to and from Ogdensburg, but after having passed the locks with difficulty she was burned to the water's edge on her first trip.

Among the canal surveys ordered by the "great canal law" of 1825 were two to connect the Erie canal with the St. Lawrence river at Ogdensburg. Because the law was somewhat obscure as to its meaning the engineer who made the surveys, James Geddes, one of the best known of the Erie canal engineers during its preliminary survey and construction stages, ran lines over three routes, one from Herkimer to the upper waters of Black river and thence to the St. Lawrence near Ogdensburg, another from Rome through Boonville to what is known as High falls on the Black river, thence in the river for forty miles to Carthage and beyond that north through the village of Gouverneur and down the Oswegatchie river to Ogdensburg, and the third from Fort Bull, a little west of Rome, up Fish creek valley, through Camden, and on north across Salmon and Black river valleys into West creek valley and thence on to Indian river valley and down that valley and through Black lake to Ogdensburg.

Like many another of these early canal surveys, the construction of the waterway did not follow. In this case, however, the canal was built eventually. The route selected was substantially the second of those just described, but terminating at Carthage. In 1836 this was authorized; between 1838 and 1855 the main canal was constructed. It left the Erie canal at Rome and ran north, fol-

lowing the Mohawk river valley as far as that was available; it approached the Black river valley at Boonville, where it attained its summit level; continuing it descended to the north, paralleling the Black river and finally dropping into that stream at the village of Lyons Falls. This canal was supplied with water through a feeder from Boonville to Forestport, which was built between 1838 and 1848. The work of making the river navigable between Lyons Falls and Carthage was begun in 1854 and finished in 1861. This portion of the waterway has been known in canal history as the Black River Improvement; in its natural state it was almost capable of being used for navigation.

The number of locks on the Black River canal is unusually large. Between Rome and Lyons Falls, a distance of about 35 miles, there are 109 locks, or an average of more than three to the mile. This peculiarity of contour led to some very interesting investigations before the canal was built. The plan of placing boats on cradles and running them up inclined planes on rails was seriously considered. This was the only New York canal for which such plan was ever contemplated.

The Black River canal is still a part of the State system, but only a portion of it has been much in use of late. From Boonville south it is open for traffic. Years ago the river navigation was cut off by reason of the dilapidated condition of the connecting lock. Until recent repairs the section between Boonville and Lyons Falls was for years in such condition that it was seldom used.

When petitions were being presented to the Legislature for the building of the Black River canal the large lumber supply in this vicinity and the importance of this section of the state as an agricultural, dairy and grazing region were among the chief arguments in its support. Another reason for constructing this canal was the need of the water it could bring to the Erie canal. Mr. Geddes in the report of his survey in 1826 had cited this possibility and without doubt this proved to be the strongest reason of all those advanced. It is probable that the canal would have been abandoned long since, except for this need. In fact in 1874 the constitutional restriction forbidding its sale was removed from this branch along with other lateral canals subsequently abandoned and only a favorable report by a special commission of expert investigators saved it from the fate of the others. Moreover, that the value of this canal as a water feeder was recognized from the beginning is shown by the official name bestowed upon it by the authorizing law, which

states that it shall be known as "The Black River Canal and Erie Canal Feeder."

During the many years since the Black River canal was begun the State has been engaged in constructing an extensive system of reservoirs in the Adirondack forest, those on the headwaters of the Black river being used for storing a canal supply, while others replace the amount of water diverted from the Black river for canal purposes. The Black River canal is the channel through which the canal supply reaches the Erie branch. And now these reservoirs and the connecting canal have been retained for the Barge canal and in addition two vastly larger reservoirs have been built close to the old system.

Almost as soon as construction work had begun on the Black River canal, agitation was started for extending the waterway in various directions, and among the routes proposed at that time was one which was substantially the same as that surveyed in 1911 and 1912. In response to petitions in 1838 and again in 1839 the Legislature of the latter year made provision for surveying these routes. In 1840 the report of the engineer, Edward H. Brodhead, was submitted to the Legislature. The estimated cost of the proposed canal of that early day becomes interesting in comparison with the estimates of the recent survey. Of course the two are not truly comparable, since the sizes and character of waterway and the conditions of building are so widely different. A brief summary of Mr. Brodhead's estimates shows the following:

Carthage to Sacketts Harbor — Length, $31\frac{1}{4}$ miles; 50 locks, 480 feet lockage, total cost with stone locks, \$1,444,614.28, with composite locks, \$1,230,629.28, with wooden locks, \$1,040,027.28.

Carthage to Dexter — Length, $27\frac{3}{4}$ miles; 50 locks, 480 feet lockage, total cost with stone locks, \$1,394,036.32, with composite locks, \$1,180,176.02, with wooden locks, \$988,943.02.

Carthage to French Creek (now Clayton) — Length, $34\frac{1}{2}$ miles; 48 locks, 480 feet lockage, total cost with stone locks, \$1,327,874.67, with composite locks, \$1,086,585.67, with wooden locks, \$894,108.67.

Carthage to Ogdensburg — via Oxbow and Oswegatchie river — Length, $77\frac{1}{8}$ miles; 54 locks, 527 feet lockage, total cost with stone locks, \$1,681,150.41, with composite locks, \$1,417,410.41, with wooden locks, \$1,179,910.41. Via Gouverneur — Length, $72\frac{3}{8}$ miles; 64 locks, 621 feet lockage, total cost with stone locks, \$2,515,199.87, with composite locks, \$2,217,566.87, with wooden locks, \$1,948,150.87. Via Little Bow Landing and Oswegatchie river —

Length, $72\frac{3}{8}$ miles; 53 locks, 517 feet lockage, total cost with stone locks, \$1,954,274.48, with composite locks, \$1,688,433.48, with wooden locks, \$1,447,230.48.

The introduction of a bill to build the extension followed the presentation of the report, but it was defeated upon final vote. The Assembly, however, passed a resolution asking the canal commissioners for a report on the probable amount of revenue to be derived from the proposed extension and also the probable increase which might be expected from the canal already under construction if the extension were added. At the next session, 1841, the commissioners made a report as directed, but it was evasive and imparted no satisfactory information. A bill for the undertaking introduced that year did not emerge from committee and although the agitation continued for a while, in a few years the whole matter dropped out of sight.

One of the reasons urged at that time for the extension is worth a brief glance. It was argued that from a military point of view it was necessary that the Black River canal should extend to Lake Ontario, since the British Government, at considerable expense, had within a few years constructed the Rideau canal, which gave them safe passage to the eastern end of the lake through the interior of Canada. This short extension in New York, it was urged, would enable the United States to maintain its position in time of war at a great saving of expenses in the transportation of armaments and stores. In a way this argument was good, especially at that time. Of course we already had entrance into Lake Ontario by way of the Oswego canal, but there is a large reach of border at the eastern end of the lake north of Oswego. It is a fact that during the War of 1812 Sacketts Harbor was considered so important a post that large amounts of military stores were carried thither overland through the Black River country at an expense, it is said, of more than two million dollars.

But to come to the subject immediately in hand — the recent agitation for a canal of modern size between Carthage and Lake Ontario. About 1911 the people of northern New York are said to have become much aroused over the lack of transportation facilities in their territory, there being only one railroad within a region of considerable extent. They could see but little prospect of further development unless better means for transportation were afforded and they had little or no hope that these increased facilities would come through the extension of the existing railroad or

through the building of competing lines. Their deliverance, therefore, from a condition that was rapidly becoming acute seemed to lie in the repair and extension of the Black River canal. Once this idea took hold of the people of this region they all became enthusiasts for a new canal — the scheme to include not only substantial repairs to the existing canal, which stretched from Rome to Carthage, but also an extension, to have Barge canal dimensions, from Carthage to Lake Ontario. They urged their representatives in the Legislature to work toward this end and the result was an appropriation of \$50,000 for repairing the old canal between Boonville and Carthage and also a sum for making a survey of the proposed extension.

It had been learned from a statistical survey of the region that there was at that time an annual in-bound and out-bound traffic of a million and a half tons suitable for canal carriage. The main force impelling the people to seek new transporting facilities, however, was a desire to expand commercially. Development was at a standstill and industrial growth must cease, they declared, unless better means for carrying their products should be afforded. This is largely an agricultural and a grazing country and also the manufactures are of considerable importance, particularly the making of paper. The mineral resources also are of no mean proportions. There abound high grade magnetic iron ore, iron pyrites, marble, limestone, sandstone and granite and in smaller quantity there are zinc, lead and hematite. Large development along all these lines, agriculture, manufacturing and mining, was probable, the people thought, but it all seemed contingent on better transportation.

Although the appropriation for the State Engineer's survey of the new route was not large the investigation was thorough and the resulting estimate from tentative plans reasonably accurate. Every feasible route or portion of route was surveyed and estimates made along each, so as to allow a selection of the best. The question of water-supply was carefully studied and the estimates included amounts for suitable storage reservoirs and feeders. Care was taken to include sums for all probable land purchases and damage claims. The experience gained on the Barge canal was applied to all parts of the surveys and estimates. The law called for examination solely along engineering lines and therefore no attempt was made to investigate traffic conditions or any feature which might bear on the question of advisability of construction. Louis A. Burns, Resident Engineer, was in immediate charge of making the surveys and esti-

mates. His partial report is contained in the annual report of the State Engineer for the year 1911 and his complete report, which goes into considerable detail, in that for 1912.

A summary of this report shows a length of 31.36 miles according to the selected route, a need of 24 locks and an estimated cost of \$16,319,580 for the waterway, if the prism should be the same size as that of the Barge canal and the locks 45 feet wide by 328 feet long between gates. For a channel of the same size but with locks somewhat smaller, 28 feet wide by 188 feet long between gates, the estimate was \$14,605,980. In 1913 the Legislature ordered the surveys of five prospective canals, the Black River extension being one of them. In reporting on these surveys the State Engineer said that subsequent to his former report the courts had handed down certain decisions with respect to the settlement of damages growing out of the appropriation of lands and waters which warranted a review of the earlier estimate and therefore he would increase the estimate from \$16,300,000 to \$19,000,000.

In March, 1912, before the full report of the survey was quite completed, at the direction of the State Engineer, Mr. Burns made a verbal report and submitted estimates of cost in round numbers on five tentative propositions. This was done for the purpose of securing information upon which a legislative bill might be drafted. This bill as first introduced carried the sum of \$14,000,000 for a canal with prism of Barge canal dimensions but locks of the smaller size. Later a new bill was substituted and in this the amount was \$16,000,000, which provided for a waterway with both prism and locks of full Barge canal dimensions. In its course through the Legislature two other schemes had been included in this bill, one the enlargement of the Glens Falls feeder and the other the reconstruction of the Chemung canal. The bill carried a total of \$25,000,000 and passed both branches of the Legislature, but failed of approval by the Governor. The reason assigned by the Governor for his veto was the greater need at that time for funds to complete the State good roads system.

Again the next year a referendum canal measure was introduced in the Legislature. This included besides the three canals contained in the 1912 bill two additional propositions, one a waterway to connect Flushing and Jamaica bays and the other the reconstruction of the abandoned Delaware and Hudson canal from Rondout on the Hudson river to the Pennsylvania line. It carried an appropriation of \$55,000,000. In the Assembly it passed to third reading, but was

recommitted after several fruitless attempts to get the Governor to sanction its passage. He objected on the very reasonable ground that only for the Black River project had surveys and reliable estimates been made and it was better, he thought, to wait until the other routes should be surveyed before submitting to the electorate any proposition concerning them. Furthermore he deemed the erection of public buildings of so much greater importance at that time that it should take antecedence over the canal bill.

Another bill affecting the Black River project had a place in the 1913 Legislature. Under the appropriation for work on the old canal from Boonville north, repairs had been made as far as Lyons Falls, the place where the canal begins to use the Black river channel in its further course to Carthage. This work was done during 1911 and 1912 and had been accomplished well within the \$50,000 appropriated, but there still remained the dredging of the river section, which it was proposed to do in 1913. It was found, however, that additional funds would be needed and so a bill calling for \$50,000 was introduced. The repairs already made would be of small avail unless the whole scheme were complete. This bill passed the Legislature, but was vetoed by the Governor without comment.

Acting on the suggestion of the Governor the Legislature of 1913 passed a bill for additional canal surveys, which received his approval. This is the law under which were made the four surveys we are about to consider. But before entering on these discussions it may be added that in the next attempt to push the Black River scheme it was linked in legislative experience with three of the other projects surveyed under this law. In 1914 this omnibus canal bill was introduced and passed the Assembly near the close of the session but failed of passage in the Senate. It carried a bond issue of \$68,000,000 and included four projects, the Black River, the Chemung, the Glens Falls feeder and the Jamaica Bay-Flushing Bay.

The law of 1913 (chapter 220) which enjoined upon the State Engineer the work of surveying five proposed canals described the several projects as "the extension of the Black River canal, the reconstruction of the Chemung canal, the conversion of the Glens Falls feeder into a canal, the construction of a canal between Flushing river and Jamaica bay and the construction of a canal from Newtown creek, sometimes known as Nassau river, to connect with the proposed canal between Flushing bay and Jamaica bay." As the investigation of the Black River extension had been completed scarcely a year earlier, new surveys were made only for the four other waterways. We shall consider them in the order of mention in the law.

CHEMUNG CANAL RECONSTRUCTION

As the phrasing indicates, the Chemung canal project contemplated the rebuilding of a waterway which once existed, or more properly speaking, two waterways, for one was built by the State between 1830 and 1833 and the other by private capital between 1852 and 1858. Moreover one short section of the old Chemung canal had already been reopened, being considered a part of the Cayuga and Seneca branch of the Barge canal. To familiarize ourselves with the situation and to understand the reasons which prompted the desire for this addition to the State transportation system, we must again look into the history of previous canal activities.

The early peopling with white settlers of the valley of Chemung river and also of much of the adjacent finger lakes region came as a direct result of one of the most important military expeditions of the Revolution. In that war the colonists tried to induce the Indians to remain neutral, but in this they were not successful and most of the red men, who then inhabited and ruled the territory west of Oneida lake, became the allies of our foes. The tragedies of the ensuing savage warfare provoked the colonists beyond endurance and when these culminated in the horrors of Wyoming and Cherry Valley they were driven to a campaign of reprisal, which resulted in breaking forever the power of the Six Nations, that formidable Iroquois confederacy. General Sullivan conducted this campaign and in it a third of the Continental army was engaged. His forces advanced from the south through Pennsylvania and at Tioga Point were reinforced by troops under General James Clinton, who had come down the Susquehanna valley. Pushing on near to the place where Elmira now stands, they encountered and in a most desperate battle defeated the Indians, who had gathered there in force to meet them under Brant and Butler. Sullivan's victorious army swept northward and westward, leaving ruin and devastation everywhere in its wake, thus carrying out Washington's orders to inflict on the Indians every injury which time and circumstance would permit.

During this expedition General Sullivan had addressed a letter to General Washington on the subject of uniting the northern and the southern waters. Washington had for years been intensely interested in waterway projects. His love for his country found expression in the desire for her prosperity above all else and his training as an engineer led him to see in improved transportation one of the greatest means toward the end. He appreciated the possibilities

disclosed by Sullivan's letter and presented the matter to Congress, but without result. This was probably the first suggestion for waterway improvement along the route later occupied by the Chemung canal. After the war the treaty of Fort Stanwix threw this region open to white settlement and the stories told by the soldiers in praise of the fertility and beauty of the Chemung valley quickly brought a tide of emigration to this fair land. Thus it was that the Chemung valley was early settled by the whites and had a part in the first of the agitation for canals. As early as 1812, five years before the Erie was begun, James Geddes, under the direction of the canal commissioners, explored the route for this prospective canal and reported favorably upon it.

To appreciate the feeling of the early advocates for the Chemung canal one must remember that only about twenty miles separated the head of Seneca lake from the Chemung river at Elmira, that Seneca lake stretched northward for some forty miles and beyond that there flowed a great river which led either to Lake Ontario and on down through its mighty outlet to the sea, the St. Lawrence, or to the Mohawk and the Hudson rivers by way of Oneida lake and an artificial channel, and that the Chemung reached the Susquehanna in less than another twenty miles and the Susquehanna continued south for many miles, crossing the whole of Pennsylvania and flowing into Chesapeake bay. When these natural streams were still sufficient for the needs of the navigation of the day, this short link between two such extensive chains was of great importance. Later, when the two canals across this divide came to be built, the States of New York and Pennsylvania had built also canals along the whole length of these natural watercourses.

There was a feeling too that the articles of commerce which were to be exchanged between the north and the south were of supreme importance. First there was the salt from central New York and then there was the coal from northern Pennsylvania, and this latter commodity has always furnished a cogent reason for canal construction. At one time, it is interesting to note, it was possible to start from New York harbor and go by canal boat through a long, circuitous, inland channel to Chesapeake bay, traveling along the course roughly described in the preceding paragraph. The route extended first northerly up the Hudson river, thence westerly through the Erie canal to the junction of the Cayuga and Seneca canal and then turning south through the latter canal it continued on southerly through Seneca lake and the Chemung and Junction canals to the

Pennsylvania line and then still continuing southerly it passed through the Pennsylvania canals and on into Chesapeake bay — a long journey of nearly eight hundred miles between these two portions of the Atlantic ocean and all of it far inland.

We find that by 1815 there was sufficient interest in the prospective Chemung waterway to cause the incorporation of a private company to undertake the building of a canal from Seneca lake to the Chemung river at Elmira, or Newtown, as it was then called. Two years earlier a company had been formed for opening navigation between Seneca and Cayuga lakes and this contemplated improvement had made the proposed connection of the northern and southern waters even more desirable. Although the improvement between the lakes was made within a few years the company which was to build the canal to the Chemung valley never advanced their project to the stage of construction.

Disappointed in the hope of attaining their desires at the hands of the incorporated company, the people of this region petitioned the Legislature year after year, asking the State to undertake the work, and in 1825 this route was included in the "great canal law" as one of the seventeen surveys to be made. James Geddes, the man who had explored the route in 1812 and who had later won distinction as a chief engineer on the Erie and Champlain canals, made these seventeen surveys. His report advised building the canal and also the feeder, which would be almost as long as the canal itself. The State did not respond immediately to the appeals for this canal but by 1829 the advocates were successful and its construction was authorized. The law directed the canal commissioners to proceed with the building, provided they could complete the canal and the feeder at a cost not to exceed \$300,000.

The commissioners thereupon directed Holmes Hutchinson, another engineer of note on the early canals, to make detailed surveys and plans and later to take charge of the work of construction. It was Mr. Hutchinson's boast later that he built the canal for less than his estimate and that the Chemung canal was the only one of the State waterways which did not cost more than the original estimates. His estimate was \$331,125.20 and the actual cost, \$314,395.51.

This care in husbanding the State's funds was highly commendable on the part of the engineer, but the parsimony of the State in dealing with this waterway was disastrous, not so much in first restricting the expenditure, that may have been the fault of the

promoters and the engineers in not daring to ask enough, but later, when the false economy of cheap construction was discovered, in again being niggardly, and all through the existence of the canal in doling out only enough to keep the channel in a barely navigable condition.

The first locks were built of wood and on too cheap a plan to remain stable. The canal was built between 1830 and 1833, but before 1840 the locks had become dilapidated. In 1841-43 they were rebuilt, still of wood, but according to a somewhat better plan, which, however, proved unsatisfactory, for much trouble was experienced by reason of the sides being pushed in by the weight of the earth and the action of frost. Then, in order to pass boats through these locks, the timber side walls had to be cut off or pushed back. By 1850 the locks again needed renewing and a structure partly of stone, known to the engineers of that day as a composite lock, was recommended. Shortly afterward the increased business on the canal, both existing and prospective, and especially the growing coal traffic led the friends of the waterway to advocate locks of a larger size, equal to those on the connecting branches of the State system, the Cayuga and Seneca and the Erie canals. Not till the winter of 1856-57 was the rebuilding commenced. Two composite locks were constructed but still of the old size. The cost of these was so much more than the money available that the remaining locks were again made of wood and the period of renewal was protracted through 1867. During much of the existence of the canal too there was experienced a serious lack of water-supply. On the other hand there were frequent floods and sometimes disastrous damages to canal banks and structures. The cause of these troubles of course was the nature of the territory, such as the character of the soil and forestation and the configuration of the hills and valleys. The run-off of the streams was what is known as "flashy." Storage of the waters would have corrected both the lack and the over-supply. Surveys were made for reservoirs, but the State made no provision for building them.

The early desire for waterway communication between New York and Pennsylvania was only partially met by the construction of the Chemung canal. To be sure it reached the Chemung river, a tributary of the Susquehanna, but the day when natural streams furnished ample means for navigation had long since passed and so there was still a gap between the two systems, the stretch of a little less than twenty miles from Elmira to the state line. The

people of the locality continued to appeal to the State for this connection and in 1839 they were reinforced by the Senate of Pennsylvania, which sent a committee to confer with New York State authorities concerning the building of a waterway from either the Chemung or the Chenango canals to connect with their system. Pennsylvania had begun a canal up the Susquehanna valley and it was then nearing the state line and therefore the people of that state too were solicitous for a joining link. The result of the conference was a survey and estimate along the Chemung valley route. During the preceding year, it may be said parenthetically, a survey had been made for extending the Chenango canal down the Susquehanna valley from Binghamton to this same point of junction with the Pennsylvania system and twenty-five years later this Chenango extension was begun.

The State did not follow this survey with the building of a canal to join the State systems, but in 1846 a private company was organized to undertake the work, which eventually it did, beginning the canal in 1853 and having it in operation throughout with junctions made in 1858. It is said that this venture proved successful for its stockholders until misfortune overtook its Pennsylvania connection, the North Branch canal. In 1865 a flood nearly destroyed the latter canal and although ineffectual attempts were made to repair the damage it was never opened again but was superseded by a railroad built along one of its banks in 1869. This caused the abandonment of the private canal in 1871. This waterway was called officially the Junction canal. Locally, from the name of its chief stockholder, it was known as the Arnot canal.

The State's portion of the canal between the northern and southern waters, the Chemung canal, was abandoned at the close of the 1878 navigation season. The immediate cause of this action was a general disaffection towards the canals, especially the smaller branches, by the people of the state at this particular time, and a determination to be rid of the majority of the lateral waterways. But back of that feeling there was present in the case of the Chemung canal the long story of an unfortunate State policy, the loss of waterway connection with the coal fields, the absorption of the coal traffic by the railroads, the disappointment in not securing a channel of ample size and the years of inadequate repairs and general dilapidation.

The survey for reopening this canal and making it a part of the Barge canal system was begun in May, 1913, and finished, with all

maps, computations and estimates made, in just about a year. In the tentative plans it was assumed that the channel and the locks would be of full Barge canal size. In general the line of the old waterway was followed, but in accordance with modern practice stream beds and the bottom of valleys were utilized rather than the side-hill locations of the early canals. From Elmira to the state line this practice was carried out to its ultimate extent and the channel was to be a river canalization. A long feeder, from Horseheads almost to Corning, to secure waters to be impounded on the upper Chemung river and its tributaries, was planned, just as a feeder in this same location had been needed for the old canal. Profiting by the experience of the early engineers, very careful investigations and computations for furnishing water were made and the needs of the canal and all available records of rain-fall and stream discharge were studied, in order to provide for an adequate supply. In this part of the investigation it was assumed that provision must be made for a canal with a capacity for two million tons seasonal traffic.

Briefly it may be said that the line of the proposed channel followed the valley of Catharine creek from Montour Falls to the divide near Horseheads. The reason for beginning at a point nearly three miles from the lake was that the stretch of abandoned canal between Watkins and Montour Falls had been reclaimed and again opened in 1887-9 and later, while the Cayuga and Seneca canal was being enlarged, its size had been increased and it had been adopted as a part of the Cayuga and Seneca branch of the Barge canal system. From Horseheads to Elmira the new line followed the valley of Newtown creek, diverging from the old canal route, which was on higher ground and passed through the center of the city. From Elmira to the state line it followed in general the channel of the Chemung river. Before it finally leaves New York state this river flows for about two miles through Pennsylvania in a loop to the south. As the ground in New York state north of this loop was not adapted to canal location the tentative plans contemplated continuance in the river channel even though it lay outside of the state. In connection with the feeder four storage reservoirs were planned. Dependence was not to be placed on the natural flow of the river, as had been done for the old canal. While this storage, if the canal had been built, would have been solely for necessary water-supply, the scheme would have rendered an incidental but most beneficent service to the community in lessening the height of floods. So too

would the enlarged channel and the structures in Chemung river and Newtown creek have helped to regulate those streams to the advantage of the adjoining territory.

According to the estimate the entire cost would have been \$26,662,372. The length, including the feeder, was 48.9 miles. Twenty-eight locks were planned, with an aggregate lift of 568 feet. The difference in elevation between the termini was 310 feet. The engineer made no report concerning the probable traffic on the proposed canal nor any recommendations as to the advisability of building it. In fact the law did not require him to consider either of these questions.

Two attempts have been made to secure funds for reconstructing the Chemung canal. In 1914, as we have said, a bill including the Black River, the Chemung, the Glens Falls feeder and the Jamaica-Flushing projects passed the Assembly, but failed in the Senate. In 1916 a bill for the Chemung canal alone, proposing a bond issue of \$26,500,000, was introduced in the Assembly but never came to vote.

GLENS FALLS FEEDER CONVERSION

The next project to be reviewed is that of "converting the Glens Falls feeder into a canal." The language of the law is rather ambiguous. It would seem to imply that this feeder was not navigable. What was meant was the conversion of the feeder into a canal of Barge canal dimensions.

To understand the situation we must consider briefly the topography and a few historical facts. The old Champlain canal and the Hudson river ran parallel as far north as Fort Edward. There they separated, the river turning west and the canal continuing north toward the Lake Champlain watershed, which it reached after crossing a rather low divide between Fort Edward and Fort Ann. For years the Glens Falls feeder furnished this summit level of the canal with its needed supply of water. Starting at a dam in the Hudson just above Glens Falls, the feeder extends easterly for about seven miles and intersects the old canal near Hudson Falls. When the original Champlain canal was begun it was not thought necessary to construct this feeder, although there was some doubt even then as to the adequacy of the supply provided by other means and a survey to determine the feasibility of the feeder was made. But before the canal was completed, construction of the feeder had been started. Moreover, at the beginning it was provided with locks and made navigable for boats of the same size as those in use on the

original canal. The Champlain canal has had several lock enlargements. The feeder participated in the first of these, but not in the second—the enlargement which made the locks of the Champlain equal in size to those the Erie had before the increase in size to Barge canal dimensions.

Thus the beginning of the Barge canal improvement found the Glens Falls feeder a necessary adjunct for supplying water but of little value as a traffic feeder, for boats of only about 140 tons capacity, shorter and narrower than those in use on the main canal, could navigate its waters. The retention of this feeder, however, was contemplated by the plans for the Barge canal, since a summit level in the new canal in this same vicinity was still a necessity and the upper Hudson was the most convenient source of water-supply. But these plans did not provide for making in the feeder any changes which would increase its capacity as a cargo carrier.

The report of the survey of 1913 states that upon examination two possible routes presented themselves, one in the river channel and the other along the line of the existing feeder. Inasmuch as the bed of the river was rock, which would entail heavy costs in construction and also by interfering with water-powers would injure the very industries upon which the prospective canal must depend in large measure for its traffic, no estimates were made for the river channel route. At the eastern end of the line by way of the old feeder the course diverged away from the feeder and turned to the south, where a choice of three possible endings might be had, one by an entirely new route, one by way of the old Champlain canal and the other by the old canal and an old feeder. The first route was preferred by the engineer. The length of the proposed feeder by this line was 7.6 miles, the estimated cost, \$9,005,310, and the number of locks, ten. With the other endings the estimates were \$9,980,240 and \$10,004,287 and the lengths, 9 and 8.9 miles, respectively. The estimates were based on a channel and locks of Barge canal size. If the canal should stop at Glens Falls rather than extend a mile and a half farther to the feeder dam, each of the estimates would be decreased by \$1,400,000.

In his report the engineer gave not only the results of his survey and computations but also his conclusions from an investigation into the economic expediency of the project. Judged in the light of conditions then existing he considered that the small prospective tonnage would not warrant the construction of the canal. If, however, the State should adopt certain policies with reference to two

public questions, the business of this region might so increase as to make the canal advisable. One question was that of water-power development. Should a storage reservoir be built on the upper Hudson to regulate the flow and deliver an uninterrupted and dependable supply of power a very large increase in industrial output might naturally be expected. Also should the State adopt a policy toward the Adirondack forests similar to the national forestry policy and permit a well regulated cutting of trees, the industrial development of this section of the state would doubtless greatly increase. It was thought that sooner or later the State must adopt some such policy in its solution of the reforestation problem. The engineer considered that the three questions — canal, water-power and reforestation — must for this locality be considered as one.

The Glens Falls project was included in the omnibus canal bill of 1914, which, however, reached only to the stage of passage through the Assembly.

JAMAICA BAY-FLUSHING BAY CANAL

The two other projects surveyed under the act of 1913 were both salt water canals, situated on Long Island and within the limits of the city of Greater New York. Unlike the three other waterways mentioned in this act these two proposed canals were neither connected directly with the State canal system nor lay along routes where any canal had ever been built. Because of their connections, their location within the confines of the great metropolis of America and also because of certain novel features, the reports on these prospective canals are unusually interesting. Their proximity to the ocean adds to the interest, for New York State has had but one experience with salt water canals, a waterway in the eastern portion of Long Island, known as the Shinnecock and Peconic canal and connecting Shinnecock bay and Great Peconic bay. In the report of these two surveys the projects are called the Jamaica Bay-Flushing Bay canal and the Newtown Creek-Flushing Bay canal. These names fit the broader scope of the schemes better than the more precise language of the law and we shall adopt them in our review.

For many years before this survey there had been a strong and persistent effort to secure the construction of a canal from Jamaica bay, which is on the ocean side of Long Island, to Flushing bay, which is an arm of Long Island sound near its junction with East river. From both the north and the south there are creeks extend-

ing toward the center of the island and along the valleys of some of these streams a suitable canal location might be found. This project was brought to the attention of the Barge Canal Terminal Commission, which was created in 1909. In the same year an act authorizing a survey of this route passed the Legislature but was vetoed by Governor Hughes on the ground that the object sought by the bill could receive proper consideration by this commission. But the commission had no funds for making such a survey and so it could do nothing. Again in 1910 a bill for this survey was introduced, and since the Governor had linked the Terminal Commission with the project, the members felt warranted in taking some action and accordingly they held a public hearing on the pending bill. At this hearing many representatives from commercial and business organizations were in attendance and all of them favored not only the bill but the construction of the canal as well, not an opposing voice being heard. The terminal commissioners, therefore, when the bill had passed and was in the Governor's hands, sent a letter to the Governor, telling of their approval of the proposed survey and setting forth its need if they were to reach an intelligent conclusion as to the desirability or even the feasibility of the canal. But the Governor again vetoed the bill. In their final report in 1911 the terminal commissioners recommended making this survey. In 1912 a bill to construct the canal was introduced but failed to pass. Then in 1913 came the act we are considering, the law authorizing the survey. But there had been estimates made before this time, probably, however, upon rather meager data. These were made by the authorities of the borough of Queens and were based on building a canal in a tunnel part of the way. Their figure was \$12,000,000.

To understand what was perhaps the most potent reason for advocating this canal, we must know that there was at this same time a project on foot to locate in Jamaica bay a large central terminal, which should have facilities so extended and so complete as virtually to make of this section of the city, divided from the Atlantic ocean as it was by only a narrow strip of land, what might be termed a great subport of the port of New York. No project was being pressed with greater zeal and none had a larger array of endorsements from the commercial and trade organizations of the city than this Jamaica bay terminal scheme. The magnitude of the enterprise may be appreciated when it is known that the plans contemplated using the entire bay and its adjacent marsh lands for the proposed harbor development and the aggregate area of this territory was 28,870 acres, or 45½ square miles. It was considered that

the city, the State and the Federal governments would coöperate in producing this mighty terminal.

In traversing Long Island from Jamaica bay to Flushing bay salt marshes are encountered for the first two miles. Then comes a gently-sloping, sandy plain, varying in height from twenty to forty feet above mean high tide and extending for another two miles; next a steeper, irregular slope to the backbone of the island, a ridge which is composed of glacial drift and till and has a maximum elevation of a little more than a hundred feet; then a steep descent and lastly a level stretch of salt meadow situated in a deep indentation of the main ridge and extending about three and a half miles to Flushing bay.

Since each end of the proposed canal would open on an arm of the ocean, the question of tides and tidal currents had to be considered. Observations showed high tide occurring in Jamaica bay about three hours after low tide in Flushing bay and differences in elevation of from about four to six feet between the two bays at a given time. A sea-level canal with unregulated water-surface under these conditions would cause currents which would be detrimental to navigation and disastrous to the integrity of the channel. Accordingly a lock with double-acting gates was planned for each end of the canal.

Three types of canal were considered in the tentative planning. These were: (1) A sea-level, open-cut canal with two locks; (2) A high-level, open-cut canal with four or more locks; (3) A sea-level canal in a tunnel through the high portion of the island. Estimates were made for the first and third types. The second type would necessitate the pumping of water to the high levels and when investigation showed the enormous cost of such pumping this scheme was no longer considered. The sea-level, open-cut channel proved to be the cheapest to construct and in spite of its several objectionable features this was the type preferred by the engineer. The tunnel scheme on the other hand was more acceptable to the borough authorities and the owners of the affected property. This was because it would not disturb street plans and would obviate several bridges. But the cost was about one and two-thirds times that of the all open-cut type. The tunnel would contain a double conduit of reinforced concrete having channels of fifty feet width each with columns between the channels, which, because of the comparatively large ratio of cross-section of canal to that of the boat would permit a rapid and easy displacement of water by a moving boat. A channel and tunnel of the dimensions planned would permit

the meeting and passing of two boats of the largest size the Barge canal locks would accommodate.

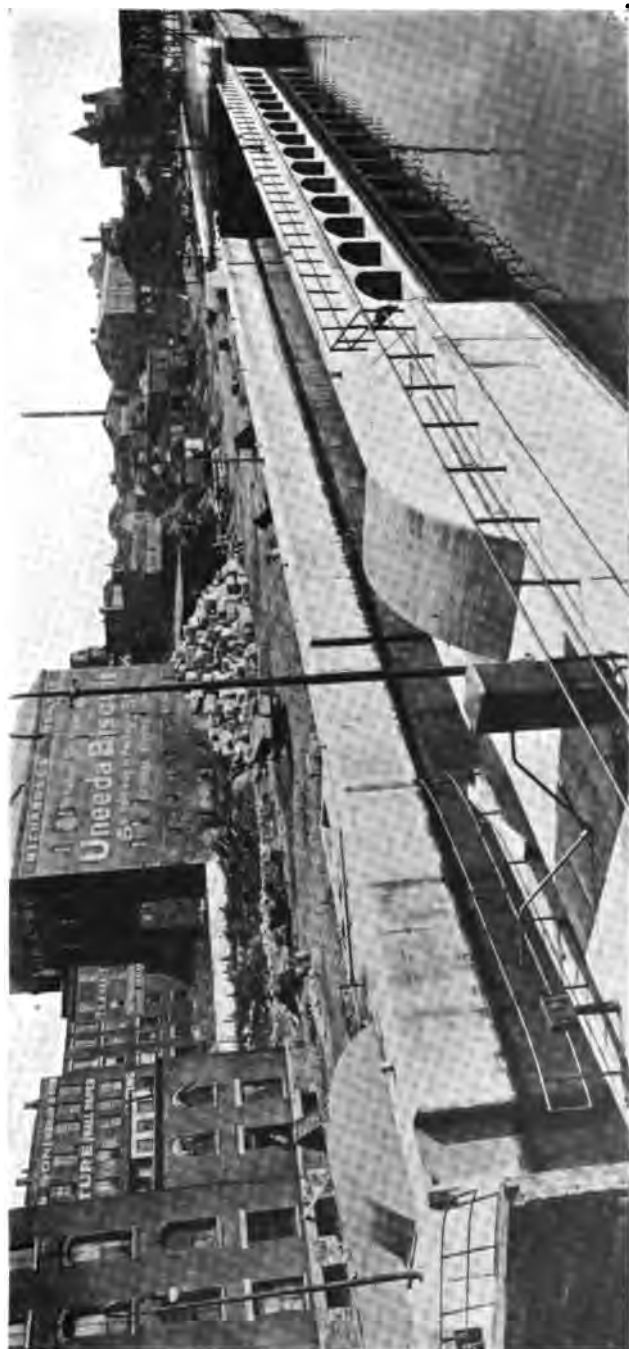
In making the estimate it was assumed that New York city would construct the channel and basins in Jamaica bay. Also the cost of work for a certain distance at the northerly end was estimated separately, since it was expected that the Federal government would improve the channel to this point. Standard Barge canal dimensions of both channel and locks were adopted for the proposed canal. The estimated cost of the canal according to the open-cut plan was \$13,211,042. If the tunnel were to be used the amount became \$20,956,476. The cost of the portion which the United States government was expected to build was \$618,468. Deducting this sum the estimates were \$12,592,574 and \$20,338,008, respectively.

The advantages claimed for this proposed canal were the saving of distance and the avoidance of congested channels and rough seas in transporting Barge canal cargoes from the Hudson to the Jamaica bay support, also the creation of additional water-front, the reclamation of large areas of marsh land, the disposal of sewage and the linking of the Barge canal and the Hudson and East rivers with a proposed inland waterway along the south side of Long Island. In his report the engineer enumerates these claims and then points out that much of the benefit would be local rather than state-wide and that the saving in cost of carriage because of shortened distances would not compensate the State for the large expenditure. He concludes that a reason for constructing the canal must be sought in the indirect and local advantages rather than in such direct saving of time and cost of transportation as would benefit the whole state.

Attempts have been made twice to get legislative authorization for the Jamaica-Flushing canal. In 1914 a bill which included this and three other projects passed the Assembly but not the Senate. In 1920 a bill for this canal alone, carrying an appropriation of \$35,000,000, was introduced in both branches of the Legislature but never emerged from the committees.

NEWTOWN CREEK-FLUSHING BAY CANAL

Coming now to the second of the Long Island waterways, the Newtown Creek-Flushing Bay canal, we find a scheme which from time to time had been under consideration for more than a hundred years. Its purpose was to connect Newtown creek with Flushing bay by means of a channel cutting across the northwest corner of Long Island. The topography of the region is favorable, there being a creek valley on the west which extends inland to a central



Siphon lock at Oswego. At the junction of Barge canal and Lake Ontario navigation. The only siphon lock in America and the largest lock to which the siphon principle has been applied.





ridge, while on the east there is a similar stream valley and also a stretch of marsh land, both extending westerly to this dividing ridge, which is about three-quarters of a mile wide and from forty to fifty feet high and is composed of glacial drift.

The surveys of these possible routes determined a line by way of the marsh land which would run directly to Flushing bay, while by following the other easterly valley the line would intersect the route of the proposed Jamaica Bay-Flushing Bay canal and stop there, utilizing that waterway for further passage to Flushing bay. The latter route was the one chosen for estimate, since computations showed this to be the cheapest scheme and also the better in several other respects. But if this project had been considered as a separate enterprise and not in conjunction with the canal between Jamaica and Flushing bays, the marsh meadow route might have proved the more advantageous.

A sea-level canal was the only type considered for this project. Observations of tides showed that here too it was necessary to place a lock at each end of the waterway, but in this instance the lock planned for the north end of the Jamaica Bay-Flushing Bay canal would serve this canal also. The estimated cost, based on a channel and lock of Barge canal dimensions, was \$5,894,144.

Advocates for the project claimed that it would increase wharfage space, induce commercial development of the district traversed, provide for sewage disposal and furnish a channel by which the dangerous navigation of Hell Gate and East river might be avoided. These advantages, like those of the other Long Island project, were chiefly of a local character. So the engineer pointed out in his report and he added that the probable commerce would not be large. If the proposed canal should be looked upon as a Barge canal terminal and as such be considered a state-wide benefit, its cost for this purpose was excessive, since other near-by terminal sites, equally as good, were available and the saving in expense would be considerable.

The reports of the canal surveys of 1913 are contained in the annual report of the State Engineer for the same year, but in an abridged form they were transmitted to the Legislature as a special report on March 11, 1914. In the latter document State Engineer Bensel concludes with the following summary:

"A summary of cost of the five projects contained in the bill authorizing these surveys is as follows:

Extension of Black River canal.....	\$19,000,000
Reconstruction of Chemung canal (portion within New York state)	25,250,000
Conversion of Glens Falls feeder into a canal.....	9,000,000
Construction of canal between Flushing river and Jamaica bay	20,338,008
Construction of canal from Newtown creek to junction with proposed canal between Flushing and Jamaica bays	5,894,144
	<hr/>
	\$79,482,152

"It is to be noted that in this summary the portion of the Chemung canal lying in the state of Pennsylvania is not included. The estimate for this is \$1,250,000.

"Also, the amount for the Jamaica Bay-Flushing Bay project is the estimate for the sea-level canal with a tunnel section. If the all open-cut type is desired, then \$12,592,574 should be substituted. Both of these figures are based on the assumption that the Federal government will construct the northern portion of this canal, which is estimated to cost \$618,468."

BARGE CANAL BRANCH, SENECA RIVER TO AUBURN

A few years later another attempt was made to add a branch to the State canal system. The Legislature of 1917 was induced to vote an appropriation for making a survey to extend the Barge canal to Auburn. The alignment of this proposed waterway, as set forth in the act, was to follow in general the outlet of Owasco lake between the city of Auburn and the village of Port Byron.

Auburn has never enjoyed the advantages of water transportation. In 1832 a private company was incorporated to connect it with the State system, but nothing ever came of this venture. The nearest point on the Erie canal was seven or eight miles away. In the early years, however, the city had the best of traffic facilities aside from water carriage. First, in the days of the stage coach, it was on one of the most important highways that crossed the state. Then, when the railroad came, following close to the highway, it still was on the most important artery of travel, the main line of the chief railway. But after the railroad straightened its course between Syracuse and Rochester, Auburn was side-tracked and was left on a minor branch. It is no wonder then that the people of this city, when a new avenue of commerce large with promise was coming so near to them, should want a branch of it to penetrate their borders.

Although the canal itself has not run through Auburn, the stream which flows through the city, the outlet of Owasco lake, has for many years been a feeder of the state waterway and the State has maintained a dam to make a canal reservoir of Owasco lake, which lies a few miles above the city. Some of the canal feeders have been made navigable, but this one never has. In effect, then, the scheme in question was to make this feeder navigable and to build it of sufficient size to allow the passage of such boats as should navigate the Barge canal.

Owasco outlet flows north in a fairly direct line from Owasco lake to Seneca river, passing through Auburn and Port Byron on its way. At the latter place it encountered the Erie canal, the old channel which has recently been superseded, and here its waters were diverted to feed that canal. At its mouth it now meets the new Erie, the Barge canal, which here lies in the bed of the canalized Seneca river. In the valley of this outlet lay the shortest and most natural route for a branch from the Barge canal to Auburn and under ordinary circumstances a survey for such a canal would have followed this stream to its mouth. The actual survey, however, after proceeding down the valley to Port Byron, turned sharply to the west and continued in that direction to the vicinity of Montezuma, where the line of the Barge canal was intersected. The reason for this was the crossing of two railroads, the West Shore and the New York Central, which a direct line would have necessitated. Such crossings would have been costly, much more costly than the short additional length required to reach the main line of the canal near Montezuma after it had itself crossed these railroads. Westerly from Port Byron the old canal alignment was followed for much of the way.

The proposed canal to Auburn was to be about twelve miles long and to have seven locks, five dams and from eight to ten bridges. The dams would have Taintor gate regulating sections and two of the locks were quite interesting in design—built tandem and of thirty feet lift each, or an aggregate of sixty feet at one location. Barge canal dimensions were assumed for both channel and locks. Along the Owasco outlet seven power rights were encountered and damages for these had to be included in the estimate. Also there was an item of considerable amount for providing an ample water-supply, which was to be done by making Owasco lake, the only practical source of supply, capable of impounding more water. As Auburn depends on this lake for its water-supply, sufficient for both canal and city had to be provided. The estimated cost of the canal,

including power rights, water-storage and all other items, was \$9,240,000.

A certain fact, which is mentioned only in an incidental way in the report on the Auburn survey, becomes somewhat illuminating when we stop to consider it. Perhaps it will explain why this proposed canal and indeed why all of the recently projected additions to the State system have failed to pass beyond the stage of preliminary survey. The report states that in determining the amount of water needed for operating the prospective canal to Auburn it was assumed that 500,000 tons of freight would be moved in a season. Now let us see what it would cost the State to move these half million tons of freight. At four and a half per cent, the rate of interest then prevailing on new State bonds, the annual interest on the estimated cost of the canal would be \$415,800. This would be eighty-three cents for each ton moved, or about seven cents per ton per mile, a sum at least ten times greater than the average rail rates before the war disturbed normal conditions, and nearly a hundred and forty times greater than the cost of transportation on the enlarged State canals as estimated by the committee which formulated the Barge canal policy in 1899. And thus far we have considered only interest on first cost, entirely neglecting weightier matters, such as repairs and operation and the sinking fund to liquidate the debt of construction. But we need not proceed; the partial calculation sufficiently illustrates our point.

During the legislative session of 1922 a somewhat feeble attempt was made to bring the authorization of this project to an issue. A bill carrying \$8,800,000 was introduced in both the Assembly and the Senate but it was never reported from the committees to which it was referred.

CANAL IMPROVEMENT, TONAWANDA-BUFFALO

The next proposition to review, while it contemplated an addition to the State canal system, differed widely from any of the proposed branches we have been considering. To be sure it looked toward the enlargement to Barge canal dimensions of the existing Erie canal between Tonawanda and Black Rock harbor, Buffalo, but its chief purpose was to provide at the western end of the Erie canal a channel both safe and suitable for boats plying on other parts of the Barge canal, should the route by way of the Niagara river — the route to be used under Barge canal plans — prove unsatisfactory. The Legislature of 1917 (by chapter 743) directed the State Engineer and the Superintendent of Public Works to investigate the two

routes and after studying the situation to report on certain specified topics.

The whole question hinged on the ability of Barge canal craft to navigate against the current in Niagara river. Since this stream carries the accumulated waters of four of the Great Lakes and since Niagara falls is situated eleven miles below Tonawanda, there exists a current of considerable strength, which is increased in velocity whenever there is high water in Lake Erie or when heavy storms from the west pile up the waters at the eastern end of the lake and drive them into the river channel. If, in order to enable barges to stem this current, it should become necessary to place in them an over-installation of power, more than that required to propel them at desired speeds through other sections of the Barge canal, then the cost of operation would be correspondingly higher and as a consequence freight rates would be increased. This question, therefore, was one of prime importance to Barge canal traffic. The old canal between Tonawanda and Black Rock harbor, it should be remembered, although paralleling the river, was a wholly independent channel and free from current.

State Engineer Williams and Superintendent of Public Works Wotherspoon found little existing data on the subject of currents in the Niagara river and so they were obliged to have observations made especially for their use. These showed a maximum velocity of 2.76 miles per hour. In their report the officials stated that such a velocity did not produce an impassable current against which to tow. Power insufficient to propel a power boat with a reasonable number of consorts at a speed of at least six miles an hour, they considered, was also insufficient for economical operation on the Barge canal.

Since they did not consider the current in Niagara river prohibitive of successful Barge canal navigation, they reported against enlarging the old canal to Barge canal dimension and substituting it for the river route. They did recommend, however, that the State should retain and operate this portion of the old canal. It would serve for the passage of small boats and also would be available, should future experience prove its enlargement advisable.

The act authorizing this investigation of routes between Tonawanda and Buffalo required that an estimate be made of the cost of improving the old canal from Tonawanda to Black Rock harbor. In compliance with this request the State officials submitted estimates on six propositions. These were: (1) High-level line from Tonawanda to Black Rock, estimated to cost \$6,252,507; (2) High-level

line from Tonawanda to Black Rock (differing from No. 1 in wall construction), estimated at \$6,121,798; (3) Low-level line from Tonawanda to Black Rock, estimated at \$7,211,130; (4) High-level line from Black Rock to Rattlesnake island (Niagara river remainder of distance to Tonawanda), estimated at \$3,195,675; (5) Low-level line from Black Rock to Rattlesnake island, estimated at \$3,619,563; (6) High-level line from Tonawanda to Black Rock, channel eight feet deep, not widened, two Barge canal locks, estimated at \$737,000.

The State has not as yet deemed it advisable to construct any of the seven proposed additions for which surveys have been made. In our review of these investigations we have not had much to say about the merits of the several projects. That is not the especial province of the present volume; rather its scope is confined chiefly within the field of history. And in the case of these particular schemes we are concerned more in viewing them as evidences of a general waterway movement than in knowing the pros and cons of each individual project. But to understand the history of past events and also to permit former experiences to serve us in solving the problems of the present, we must learn why things happened as they did. So now, without presuming to criticise any of the proposed additions to the State waterway system, we would simply say that the investigations did not seem to carry conviction, either to those in authority in State affairs or to the people in general, that the projects were economically sound or the needs were so great as to warrant more than preliminary examination. In explanation of this attitude we may repeat what we have already said, that there appears to be abroad a better appreciation of the principle that waterways, to be worth constructing, must connect large industrial centers or tap some source of extended natural supply. There is also a lesser principle, the value of which has been proved by experience in New York state, which teaches that unfavorable topography so adds to the cost of both original construction and maintenance that a canal is inadvisable unless the need is great and the prospect of remunerative traffic sufficient to overcome this disadvantage. A glance at the profiles of some of our abandoned canals reveals the excessive elevations they had to overcome by means of manifold locks and suggests one reason why these waterways were deemed failures. This latter principle would seem to apply to some of the recently proposed additions.

CHAPTER XX

COOPERATION WITH THE UNITED STATES IN ATTEMPTS TO ADD STILL OTHER BRANCHES

Jamaica Bay-Peconic Bay Canal: Early History: Physical Features: Arguments for Canal: Federal Activities: State Board Created and Directed to Make Examination: One Section Only to Be Examined: Two Earlier Attempts to Promote Scheme: Work and Findings of Board: Board Ordered to Continue Investigations: Second Report—Gravesend Bay-Jamaica Bay Canal: Board of Conference Appointed: State Prior to Federal Investigation: Discussion of Bridge Problem and Traffic Regulation: Opinions of Board as to Merits of Proposal: Outside Passage Considered Inadequate: Estimates and Recommendation: Value of Jamaica Bay as a Subport: Effect of Project on Barge Canal—Harlem River Improvement: Importance of Project: Tangle into Which It Had Fallen: Board of Conference Appointed: Physical Features of Improvement: Its Early History: Facts Brought Out in Investigations: Recommendations by Board: Subsequent State and City Action.

NOT only have there been these proposals for the State to extend its canal system, but also, since the beginning of Barge canal construction, efforts have been made to persuade the National government to construct canals or improve waterways of large dimensions within our state borders. There have been three recent projects of this character and we shall recount them in turn, noticing especially the part which New York has had in each. The sites of all three are in or near New York city and at least two of them, if constructed, will have more or less bearing on Barge canal traffic.

JAMAICA BAY-PECONIC BAY CANAL

The first in order of time is the Jamaica Bay-Peconic Bay canal project. To get at the beginning of this specific enterprise we must go back to the 1907 Rivers and Harbors Act of Congress, which authorized an examination in connection with the proposed canal.

But this was by no means the beginning of the idea of a canal along this route nor indeed was it the first survey. We find that as early as 1826 Holmes Hutchinson, a well-known canal engineer of whom we have already spoken, made a report to the canal com-

missioners on a proposed water communication extending farther than the project we are about to consider, even from Gravesend bay to Peconic bay, substantially the whole length of Long Island. Probably the idea of a canal along the whole or various parts of this route was current even in colonial days. In fact there is reference in at least one colonial manuscript to an act of crude canal making — the cutting of a channel from Shinnecock bay in 1652.* Moreover, there is reason to believe that one short section of canal on the route we are discussing was built even prior to the advent of white men. The writer of a history of Long Island is authority for the statement that “traces still remain of the canal opened by Mongotucksee-Long Knife, Chief of the Mohawks.”† These traces were found on the site of what is known as the Shinnecock and Peconic canal, the only salt water canal of the State system, joining the waters of Shinnecock bay and Great Peconic bay, built by the State between 1884 and 1892.

Research shows also that in 1828 the Long Island Canal Company was incorporated with a capital of \$200,000 for the purpose of connecting Gravesend, Jamaica and Great South bays as far as Fire Island inlet. And again, in 1848, there was incorporated a second company, having a capital of \$300,000, the Long Island Canal and Navigation Company, its object being to connect Gravesend and Jamaica bays with Great South bay and also to cut a narrow neck of land across Long Island and enter into Peconic bay. So far as we can learn the former company never did anything towards constructing the canal, while the second company never went beyond making a survey.

The southern shore of Long Island fronts on the broad Atlantic and its many miles of coast would be severely beaten by the fierce storms that sweep across the leagues of ocean, had not the sea done what it sometimes does — built a barrier against its own violence. Back of this barrier, this comparatively narrow beach which the waters have piled up, lie bays and channels and islands and marsh meadows, and beyond them, sometimes at a distance of several miles from the beach where the ocean waves are rolling, is situated what may be considered the real shore of Long Island, although at certain localities rather large municipalities have been built on the narrow strips of beach. It is this favorable feature of topography which

* *The First Book of Records of the Town of Southampton*, p. 87. (Sag Harbor, 1874.) Page 105 of original manuscript record.

† *Early Long Island, A Colonial Study*, by Martha Bockée Flint, p. 40. (New York, 1896.)

has brought about the agitation for canals along the south coast of the island. The possibility of building short stretches of artificial channel to connect long reaches of open navigation, all of it protected from the storms of the ocean, has been a bright prospect to lure man's endeavor.

Briefly we may mention the natural bodies of water which a canal clear across the southern shore of Long Island would traverse. At the western end adjoining the Narrows, which connects Upper and Lower New York bays, lies Gravesend bay. Proceeding thence easterly we pass first over low land behind Coney Island, on through Sheepshead bay and other channels and marsh land into Jamaica bay, which lies back of Rockaway beach. Next comes the highest land we encounter, known as Rockaway ridge. Beyond this there are some ten miles of small bays, channels and marsh meadows before we reach first South Oyster bay and then Great South bay. This latter bay stretches for nearly thirty miles and is followed by Moriches and Shinnecock bays with small bays or channels between the three large bays. At its eastern end Long Island forks into two long, broad peninsulas, widely separated. Between Shinnecock bay on the south shore and Great Peconic bay, which lies between the forks of the island, there is a low, narrow neck of land, which we have mentioned as the place where the Indian chief is said to have opened a canal. Thus the Jamaica-Peconic project, which we are now considering, together with the Gravesend-Jamaica scheme, which we shall take up next, encompassed the whole plan of waterways along the south coast of Long Island.

We may pause for a moment and consider why the people of Long Island wanted a canal along the southern coast, glancing briefly at the arguments they advanced at the time of the recent investigations. The saving in freight costs and the development of the region along several lines of progress are chief among the reasons.

It was said that the canal would carry from 500,000 to 700,000 tons of freight, on which there would be a probable saving of \$350,000, and this tonnage would increase with the industrial development that might be expected. By way of produce it was noted that Suffolk county had some of the most productive farms and market gardens in the state, potatoes and cauliflower furnishing the largest crops, the latter product being grown in greater quantity there than in all the rest of the state and requiring for three months of the year special trains of from eighteen to twenty-five cars a day to carry it to market. That much of the southern part of the island might be turned into gardens, close to the great New York market, was the

hope of the people, and to bring in immense quantities of fertilizer and to carry out the many times greater amounts of produce a cheaper means of transportation was needed. Then there were industries which must be carried on adjacent to the proposed canal and which without it were handicapped by long hauls to the railroads. These were the oyster and fish industries and the raising of ducks. All of them were already large and would grow rapidly with favorable shipping facilities.

The increased valuations in realty that would follow the development of the region were estimated as sufficient to pay the whole cost of constructing the canal. One feature of this contemplated increase in land values was the use for summer residences of the beach which fronts directly upon the ocean. For sixty miles this was virtually unused, except at three or four places where boats or bridges gave access, and the direction of the prevailing winds makes it more desirable than any beach along the New Jersey shore. This neck of land is from a quarter to three-quarters of a mile wide and behind it lie the bodies of water which it was proposed to canalize. Along these bays and creeks there is an additional water frontage of 250 miles. Water communication was needed to render these localities easily accessible.

Still another argument was the value such a canal would have as an instrument for military defense. In the event of hostile attack New York city of course would be the prize most eagerly sought and a waterway along more than a hundred miles of the approach to the city would be of untold advantage, it was pointed out, in preventing its capture. It would pass the smaller types of war vessels, including torpedo boat destroyers, submarines and the like, and would accommodate floating batteries carrying guns of large caliber.

Latterly there has entered a new element into the desire for at least one portion of the proposed canal along the south shore. This is the plan of creating in Jamaica bay a huge waterway terminal, a veritable subport of the port of New York. As we have said, this plan lay at the bottom of the attempt to get the State to build a canal across the breadth of Long Island from Jamaica bay to Flushing bay. Failing in this undertaking, the advocates, as we shall see a little later, essayed to induce the United States to open an inside passage by way of Gravesend bay.

Reverting to the act of Congress in authorizing an examination of the Jamaica-Peconic project in 1907, we notice that under this act the United States district engineer made a report which contemplated the construction of a canal 100 feet wide and six feet deep. The

Board of Army Engineers concurred in this report, but on resolution of the Committee on Rivers and Harbors of the House of Representatives a reëxamination of the report was made by the Board of Engineers and as a result it was concluded that a more detailed investigation into the cost of building this canal was warranted. In 1909 an appropriation was made by Congress for a survey and estimate and in 1914 the district engineer submitted his report on this survey. It was not favorable to the proposed construction, but the Board of Engineers, after careful consideration, referred the proposition to the district engineer again, directing him to ascertain to what extent the State of New York and the municipalities along the line of the prospective canal would coöperate in its construction. In 1915 a hearing was held before the district engineer, at which it was brought out that all lands required for what was known as the first section of the waterway, the westerly four and one-half miles, must be deeded to the United States free of cost. At this hearing also the district engineer was promised that a bill would be introduced in the New York Legislature to provide for an appropriation of \$995,000 to cover the State's share in constructing the canal. Thereupon the district engineer made a favorable report on the project to the Chief of Engineers, U. S. Army, recommending, however, that the Federal government should construct only the main line of the canal, leaving the building of lateral branches, the furnishing of right of way and the construction of bridges for the State and the municipalities to provide for.

This report of the district engineer was in the hands of the Board of Engineers, awaiting determination by the State as to the extent of its coöperation, when the Legislature of 1917 (by chapter 317) created the Jamaica Bay-Peconic Bay Canal Board and directed its members to confer with the United States officials concerning the construction of the proposed canal on the south side of Long Island. The act appointed as members of this new board the State Engineer, Frank M. Williams, who was to act as chairman, the Superintendent of Public Works, W. W. Wotherspoon, and one other, to be named by the Governor. This third member was Joseph E. Bailey of Patchogue, Long Island. In addition to commissioning this board to confer with the Federal authorities the act directed the State Engineer to determine the cost of building the necessary bridges and also of furnishing the required right of way for the proposed canal. It also ordered the State to proceed with its share of the undertaking after the Federal government should have set aside funds for the project, provided the estimate of cost for bridges and

right of way should be not more than \$1,000,000, thus in effect stipulating that the State would not consider any coöperation beyond that amount. Another proviso was that the channel constructed by the Federal government should be at least twelve feet deep.

In making his report in 1914 the district engineer had divided the whole line of the canal into four sections, the aggregate length of which was $76\frac{1}{2}$ miles. The first section, $4\frac{1}{2}$ miles long, crossed the elevation of land known as Rockaway ridge and here occurred the most serious difficulties in securing proper alignment, since this region had been somewhat built up and the property traversed was of considerable value and the streets or railroads intersected would require bridges. The remaining three sections on the other hand involved the construction of the canal within what may be termed navigable waters and presented no difficult problems either as to alignment, the acquisition of property or the building of bridges. So far as coöperation went New York State was concerned only with the first section of the canal and the newly-created Canal Board confined its investigations to this region. The district engineer had considered several routes within this section and the routes now examined by the State board were but modifications of those he had mentioned in his report of 1914.

Recurring for a moment to the promise given at the hearing in 1915, that a bill would be introduced in the New York Legislature to provide for an appropriation of \$995,000 for the State's share toward the canal, we observe that such a bill was introduced at the 1915 session, but as this was the time when the measure for authorizing an additional bond issue of \$27,000,000 to complete the Barge canal was being brought to public attention, it was thought best to let the Long Island project wait for a year. In the fall of 1915 the State Waterways Association at its annual convention directed a committee to push the proposed legislation. The members of this committee conferred with State Engineer Williams and as a result he made a report to the Legislature recommending that the State coöperate with the Federal authorities, provided the United States would construct a waterway of Barge canal dimensions. A bill embodying this idea was then introduced, in which the extent of State assistance was limited to \$995,000. The committee had high hopes of a successful issue, especially as the Governor had accompanied the State Engineer on his trip of inspection over the route and seemed more than favorable. The whole project appeared most promising; for the expenditure of only a million dollars the State was evidently on the eve of securing an addition of nearly eighty

miles to its canal system. But opposition developed, from both the Governor and the Legislature, and the bill was never reported out of committee. During the 1917 session, however, as we have seen, a similar bill became law.

We do not need to go deeply into the activities of the newly-appointed State board. It did the work required of it and reported to the Legislature under date of December 27, 1918. The estimates it submitted were along three routes, called the Woodmere, the Hewlett and the Far Rockaway routes. Also three separate estimates had been made for each route, these being based on the prices that prevailed at three periods of time—before the war, in January, 1918, and in January, 1919. There were twenty-one estimates in all and they ranged from \$660,000 to \$1,900,000, according to the route, the prices used and the possible elimination of certain bridges.

In reporting the conclusions to which it had come the Board placed itself on record as favoring the extension of the inland waterways system of the State. It stated that, if the United States would construct the proposed canal, excavating to a depth of twelve feet and making its other dimensions correspond substantially with those of the Barge canal, so that the waterway might be considered as an adjunct to the State system, then in the opinion of the Board the State was justified in cooperating to the extent of a million dollars. The cost of building the bridges and acquiring the right of way would depend in large measure on the attitude of the residents in the communities that would be served by the prospective canal. If they should be reasonable in their demands, asking only a fair price for the lands which the State must purchase and not exacting an excessive number of bridges, the State's portion of the cost, the Board thought, could be kept within the million dollars.

There were two particular statements in this report which we must examine in detail, since they gave rise to subsequent legislative action. The Board mentioned a fourth route, the Lynbrook (not included in the district engineer's report), which it had considered but had not investigated with the same care as the other routes. It reported also that one of the lines ran near some fresh-water wells, which were owned by the Queens County Water Company and yielded the supply of water that this company distributed to the neighboring communities. In its estimates of cost the Board had not included any sum for damages which might be sustained by reason of opening a salt-water channel near these fresh-water wells. The report stated, in fact, that the Board had not been able to conduct the exhaustive investigation necessary definitely to determine to what extent, if any, these wells would be damaged by the proposed canal.

In order to get information on the two questions left thus unanswered by this first report, the Legislature of 1919 (by chapter 15) ordered the Board to continue its investigations, specifically directing it to examine the Lynbrook route and to determine what effect the construction of the canal would have upon the source of fresh-water supply.

The second report of this Board, presented to the Legislature on February 11, 1920, was not in a hopeful vein. To the two questions of special inquiry it made definite answer, but in each case the prospective expenditure devolving upon the State was not favorable for the consummation of the project. For the Lynbrook route the report submitted twelve estimates and on the problem of salt water from the proposed canal penetrating to the wells of the Water Company it contained the opinions of a water-supply expert and of the Attorney-General on the physical and legal aspects, respectively, of the subject.

In estimating for the new route six conditions as to the number of bridges were assumed. Also two sets of prices were used, pre-war prices and those prevailing in January, 1920. The six estimates based on pre-war prices ranged from \$870,000 to \$1,226,000, while the six computed on January, 1920, prices ran from \$1,094,000 to \$1,675,000. The water-supply expert reported his conviction that sooner or later salt water would reach at least a portion of the wells of the Water Company, if the canal were built on the Lynbrook route, and that the adverse effect would be immediate, should the canal follow the Hewlett route. The Attorney-General, asked by the Board for an opinion, answered that he had come to the conclusion that "the Board should proceed upon the assumption that the State would be held answerable for the damages resulting from rendering brackish the subterranean waters which feed the well in question." The Board did not attempt to estimate the amount of this possible liability, but, to show that it might be a considerable sum, simply quoted a value set in 1915 by one of the New York city departments when there was some thought that the city might acquire the property of this Water Company. That estimate was substantially \$1,700,000.

In concluding its report the Board deprecated its inability to say that the cost to the State for bridges and right of way on any of the routes examined would be less than a million dollars. In its first report the hope of keeping within that limit had been expressed, but now, because of increased costs, due to war conditions, and also because of the unwillingness of property owners to dedicate their lands, even the possibility of such hope had departed.

GRAVESEND BAY-JAMAICA BAY CANAL

The second project proposed for construction by the National government, with coöperation from New York State, was a waterway between Gravesend bay and Jamaica bay. In a broad sense this was simply a portion of the canal which had long been desired across the southern border of Long Island, but, because of recent endeavors to make Jamaica bay a most important part of the port of New York, it had become something more. It was now a scheme which stood out prominently by itself, apart from the rest of the enterprise; it had its own peculiar merits and these demanded for it consideration as a separate undertaking.

One evidence of the long-standing and firm belief in an eventual canal along this route is found in the fact that in 1864 a body known as the Kings County Land Commission, appointed to lay out a system of streets in Kings county, now the borough of Brooklyn, laid out a proposed ship canal 200 feet wide along Coney Island creek, which ran from Gravesend bay to Sheepshead bay (a part of Jamaica bay) and paralleled it with marginal streets, each a hundred feet wide and called North and South Canal avenues.

The State's share in the recent attempt to open a canal on this route began with the appointment of a body of men, known as a Board of Conference, by the Legislature of 1919 (chapter 585). This board consisted of the State Engineer, Frank M. Williams, chairman, the Superintendent of Public Works, Edward S. Walsh, and the Commissioner of Docks of New York city, Murray Hulbert.

Unlike the investigation of the route from Jamaica bay to Peconic bay, which had been examined and reported upon by the United States engineers before the State took a hand in the affair, the task set this Board of Conference was one which preceded any authorized action on the part of the Federal authorities. Before finishing its work, however, the Board was able to say that the United States engineer of the district had reported to the War Department favorably on making a survey of the proposed canal and had been instructed to proceed with this survey as soon as convenient.

Assuming that the United States would not undertake this canal unless the usual conditions were met, the same conditions as those mentioned in the discussion of the Jamaica-Peconic project, the Board of Conference made an estimate of the cost of furnishing right of way and building bridges for the proposed waterway. A canal connecting Gravesend and Jamaica bays would of necessity cut

Coney Island off from the rest of Long Island and this situation would demand bridges. Whether this area was originally a real island is uncertain, but until recent years there was a channel from Gravesend bay to Sheepshead bay that was navigable for very small boats, and this still exists as a narrow and tortuous waterway, called Coney Island creek, spanned by several low bridges. A large territory on the north side of Coney Island, which formerly was low-lying and poorly drained, had been filled in and made habitable.

To excavate a channel four hundred feet wide and thus to make Coney Island actually an island, cutting off its many people from unimpeded passage to the north, made the subject of bridges across the proposed canal a most momentous question. Travel here was always large and sometimes enormous. Those who crossed the proposed route daily the year round numbered thousands and in the summer months frequently hundreds of thousands of persons visited Coney Island in a single day, coming by surface, elevated and subway cars, taxicabs, automobiles and other vehicles. This traffic was not problematic but actual and it had rights which could not be abrogated nor even neglected.

On the other hand, if this canal should be built and the proposed terminal development of Jamaica bay should become an accomplished fact, and these two projects were so interdependent as to be really a single scheme, then it was essential that navigation throughout the length of the canal should be as free and uninterrupted as possible. Jamaica bay would be a very important part of the port of New York, but nevertheless it would be only a part of the port and would be dependent on the other parts as they in turn would be dependent on it. Therefore this connection should be complete and practically continuous in operation, for any delay suffered by ships in loading or discharging cargoes at the wharves or by the industries relying on the commerce of the canal would result eventually in a charge against the consumer and moreover it would become a tax on the commerce of the port which would tend to divert business to other ports.

In making provision for bridges there were, then, the interests of these two groups to consider — those who crossed the canal and those who navigated the canal, and the interests of the latter class, through the ramifications of business and industry, touched substantially the whole public. Also two other interests had to be taken into account. If the Federal government were to construct the channel, then the requirements of the War Department must be observed. And in addition the interests of bridge owners should

be weighed. The Board of Conference judged, however, that these several interests did not conflict so seriously as to prevent adjustment and they considered that by complying with the Federal requirements and establishing equitable regulation of land and water traffic, the problem might be solved with justice to all concerned.

The requirements of the War Department were that bridges should be of some type which would give unlimited headroom when open, that they give clear headroom when closed of at least 24 feet above mean spring flood tide and that the clear horizontal opening be at least 100 feet for a single opening, such as a bascule bridge would furnish, or 70 feet for each of two parallel openings, such as a swing bridge would provide. In making estimates for bridges the Board selected the bascule type and planned for structures which would comply with these Federal specifications — a headroom when closed of 24 feet and a horizontal opening when open of 100 feet with unlimited headroom. Whether or not the United States should construct the canal, the Board considered that it would be best to conform to the War Department requirements.

For regulating the traffic the Board thought that a scheme of operation patterned after that of the Harlem river should be adopted. It was, in fact, the harmony attained between bridge and channel traffic on the Harlem river which guided the Board in its present recommendations, leading it to believe that an equally accordant plan might be formulated for the proposed Gravesend-Jamaica canal. In a recent year the channel of the Harlem had carried a tonnage equal to one-third that of the entire foreign commerce of the port of New York and at the same time millions of persons and hundred of thousands of vehicles had crossed the river. The regulations under which the bridges on the Harlem were operated provided for keeping them closed during certain hours each day, the hours of maximum traffic across the river being selected. Not all channel traffic was stopped by this arrangement, since the headroom when the bridges were closed, in some cases somewhat less than 24 feet, was enough to permit navigation by small tugs and unrigged craft at all times. The Board in its report did not attempt to lay down a definite plan of regulation for the proposed waterway, but simply stated its firm belief that upon a detailed study of traffic an operating plan might be predicated which would safeguard the city's large investment in subway and other lines as well as the interests of corporate transit lines and at the same time adequately foster all the various kinds of legitimate traffic.

Concerning the merits of the proposal to build this canal the Board of Conference had some clear-cut and well-considered opinions, and to these it gave free expression in its report. Jamaica bay, it thought, was one of the most suitable localities for development on the New York state side of the port of New York, and this development might with profit be along the lines of either commerce or industry, or both. But in any case the development was contingent on communication with the other portions of New York harbor. If the location had been far enough away, this terminal could be developed like any other independent harbor, but being in Greater New York, it was subject to the conditions which existed in that port. As we have said previously, the various parts of the port were unusually interdependent, perhaps more so than in any other harbor.

Since, therefore, intercommunication was an indispensable requisite, it was essential that efficient means of transit be at hand. There were three possible methods—by rail, by water and by dray. Rail communication with the remainder of the harbor was decidedly unsatisfactory except with Brooklyn and perhaps with the Bronx. The only available rail route for freight to Manhattan was the long and circuitous course by way of Spuyten Duyvil and the Hell Gate bridge. Since the Pennsylvania and Long Island tubes were practically closed to the transportation of freight, there was no rail connection whatever with Staten Island or any portion of the harbor west of the Hudson river except by car-float, and this procedure, of course, transferred the method from rail to water communication. To depend on drays or various kinds of trucks for connection with other harbor points was out of the question. Jamaica bay was too far removed from most of these points to make such form of communication practicable, even if the avenues for its use had been fully available.

The logic of the situation, therefore, demanded a water connection with the remainder of the harbor that would be safe at all times of the year. To be sure there was already ample communication by water, but, as we shall see presently, this route had the menace of severe storms through much of the year. If Jamaica bay were to be developed industrially, there must be means for bringing in materials and sending out products both to the rest of the port and to its connecting waterways. If the bay were to be developed commercially and to become the great terminal which had been planned, safe water communication was still more essential, even indispensable to the success of the project.

The same practices would necessarily prevail in Jamaica bay as in other parts of the port and there would ensue an extensive use of lighters. By reason of physical conditions the port of New York had become essentially a lighter port, that is, a large portion of the freight was moved within it from point to point in lighters, barges and other harbor craft. To question whether this was the most economical practice was entirely beside the point; the condition existed and had to be met. Authorities who had investigated the leading ports of the world claimed, however, that this custom was beneficial to the port of New York and should be perpetuated in large degree. It was a fact that few ocean cargoes were either loaded or discharged at this port without some part of them being borne by lighters, and this must be the case also with steamship cargoes to and from Jamaica bay. It was imperative for its development, therefore, that a safe passage to it for small craft be available all the year round.

The existing water route to Jamaica bay was an outside passage, south of Coney Island and thence through Rockaway inlet. There was a Federal project on foot to improve the channel in this inlet. From testimony adduced at a hearing at Coney Island and from such other information as the Board was able to gather it appeared that, while the outside passage might be safe during most of the summer and parts of the spring and fall and for a few days in winter, it was very far from being safe at all times and was positively unsafe during a large part of the year for all but the larger craft. There was a probability that in the course of time this route might by natural processes be made as safe as an inside passage. Rockaway beach was constantly being extended toward the southwest, thus gradually approaching Sandy Hook. How long it would take to extend this peninsula to such a point that in conjunction with Sandy Hook it would give adequate protection at all seasons to small craft passing to and from Jamaica bay no one could tell, but at the existing rate of accretion it was estimated the process would require from fifty to a hundred years. This, the Board thought, was too long to wait, since the cost of the canal could be written off in benefits years before this period should have elapsed.

The State Engineer through his corps of engineers surveyed and mapped the route of the proposed canal and estimated the cost of erecting necessary bridges to be \$9,500,000. The Superintendent of Public Works caused an appraisal of right of way to be made. This amounted to \$882,910.20. In its report to the Legislature the Board stated that in its opinion the interests of navigation and com-

merce not only warranted but made desirable the construction of this canal between Gravesend and Jamaica bays and it recommended that the State coöperate to the extent of providing the necessary right of way. The channel proposed by the Board was to be at least 250 feet wide at bottom with sloping sides or 400 feet wide with vertical sides and was to have at least 15 feet depth of water at mean low tide. A right of way 400 feet wide was to be provided.

In this account of the Gravesend-Jamaica project we have said but little concerning the necessity of adding Jamaica bay to the port facilities of New York city. The Board of Conference itself said almost nothing on this subject — possibly because the congestion of the port was so patent as to need no comment. The port of New York in both the volume and the value of its commerce exceeds all other ports of the world. Just about half of the foreign commerce of the United States passes through this port. So far as natural facilities go it is most admirably situated to handle not only its present but a much more vast trade, the land areas being so surrounded and divided by navigable waters as to give almost ideal conditions for water transportation. The whole port, that is, the area within the customs limits, which embrace in large part the New Jersey shore opposite New York, has a total water front on rivers, bay, sound and ocean of 444 miles. But with all its natural advantages the port is notoriously deficient in terminal and docking facilities. And for many years the acuteness of this condition has been growing; in spite of inadequate wharfage, commerce has increased amazingly, while accommodations have been added but meagerly. It is easy to see, then, why the Jamaica bay scheme, with its 45½ square miles of land and water area to develop into a mighty terminal, was so well thought of by those in quest of a solution for New York's transportation problems and had become so popular with the shipping public in general.

There is another phase of the Gravesend-Jamaica proposal which we have not mentioned — the effect such a canal might have upon Barge canal traffic. If the Jamaica terminal plan should be developed, the boats plying on the State canals should by some means be enabled to reach this portion of the port without hindrance or delay. The outside passage could not guarantee this necessity. But of course the Jamaica terminal project is so dependent on the construction of some inside passage that it goes hand in hand with the Gravesend-Jamaica canal, the Jamaica-Flushing scheme or other like proposition. Should these proposals come to fruition, therefore, it is plain that the Barge canal would have a considerable share in the benefits that are expected to ensue.

HARLEM RIVER IMPROVEMENT

The third of the enterprises for waterway improvement within New York state was that for bettering navigation on the Harlem river. This was not a new undertaking; it had long been a Federal project, having been adopted by act of Congress in 1874. Although the State had thus not had a direct part in making the improvements, its coöperation was required in furnishing certain right of way and its interests were involved in several particulars. In the first place the traffic on the Harlem was enormous and doubtless would increase many fold with the completion of the improvements. While this commerce affected New York city primarily, it was of considerable importance to the whole state. Then too, notwithstanding the already available route around the south end of Manhattan and up East river, a short, safe, uncongested channel from the Hudson to East river might open to Barge canal traffic many markets in Bronx and Queens boroughs which otherwise would remain closed. As this region is large and important its active participation might notably augment canal traffic. And again, the construction of the proposed canal terminal at East 136th street was contingent by law upon the improvement under Federal authority of the Bronx kills, a project which could not advance until various conditions on the Harlem had been met.

The participation by the State in the Harlem project at this time was prompted chiefly by two circumstances. First, there was the same desire for waterway improvement and an extension of Barge canal benefits which had given rise to the nine other enterprises we have just been discussing, and this desire by the way was but a part of a wide-spread waterway agitation abroad in the land. Then, this particular project had become so involved, each part in turn so dependent for advancement upon some other part, that all progress had been blocked and any endeavor to proceed had been but to work in a circle. In large measure for the purpose of straightening out this tangle, the Legislature of 1919 (by chapter 586) appointed a board which should study the whole situation carefully and report its findings to the succeeding Legislature. This body, too, was called a Board of Conference and it consisted of the same men as those who made up the Board of Conference in the Gravesend-Jamaica canal. The State Engineer, Frank M. Williams, was chairman, and the Superintendent of Public Works, Edward S. Walsh, and the Commissioner of Docks of New York city, Murray Hulbert, were the other members. There were three particular features of the Harlem project which demanded the attention of the Board. These were the

straightening of the channel at an especially objectionable bend, the removal or alteration of High bridge and the widening and deepening of the Bronx kills. It will be recalled that the Barge Canal Terminal Commission had made recommendations concerning all of these three questions in its final report in 1911.

The Harlem river is the tidal waterway which separates Manhattan island along its northeast border from the mainland. At Kingsbridge it joins Spuyten Duyvil creek, another tidal waterway, which completes the separation of the island, extending along its extreme northern end. These two streams have a combined length of about eight miles. At the southeastern end of the Harlem river and connecting it with the East river is what is known as the Bronx kills, sometimes called the Harlem kills, a shallow and much-obstructed waterway about 4,000 feet in length, which lies between Randall island and the mainland. About midway in its course the Harlem river is spanned by High bridge. This structure was completed in 1848, a part of the Croton aqueduct improvement, and for years it carried the Croton waters at a height of a little more than a hundred feet above the Harlem river across to what was then the city of New York.

It was this short-cut channel, by way of Spuyten Duyvil creek, Harlem river and the Bronx kills, which the advocates of the scheme wanted improved, in order that there might be adequate passage between the Hudson and East rivers without going down around the Battery and back again, a distance of about twenty-five miles through a congested, in some places tortuous and not always entirely safe course. This improvement would benefit directly the east waterfront of the borough of Bronx and the portion of Queens borough lying along East river and Long Island sound, a region which had been among the first in the state in rate of recent development.

So much for the geography of the project; now a little concerning its history. Reviewing the events prior to the time of the Board's activities we learn that after the Harlem had been improved under the act of 1874 Congress adopted a new project in 1878 and this was modified in 1879, in 1886 and in 1893, and enlarged by the rivers and harbors act of 1913. The existing project, which was under the authority of the 1913 act, provided for a channel 400 feet wide and 15 feet deep at mean low water from the East river to the Hudson river, except that at two points the width was somewhat lessened. The estimated cost of this project, as revised in 1913, exclusive of the amounts spent on previous projects, was \$3,550,000. It was said that about 58 per cent of this work had been

done at this time, a full-sized channel having been excavated part of the way and a full depth of 15 feet having been made through the whole length, except at one bridge. The chief remaining obstructions, aside from the partial widths, were High bridge and the place where the channel was to be straightened.

The account of the Bronx kills project shows that in compliance with an act of Congress in 1881 a survey and report were made, the estimates being for a channel 300 feet wide and 12, 15 and 18 feet deep, respectively. Another report was submitted in 1896, with revised estimates, on a channel 300 feet wide and 15 feet deep. In 1897 a third report was made and this contained estimates for a channel of the same width but with depths of 18 and 20 feet, respectively. Yet another report was submitted, in 1902, and the estimates in this were based on a channel 300 feet wide and 18 and 20 feet deep, to cost \$1,899,480 and \$2,514,600, respectively. The Board of Engineers advised the carrying out of this project in accordance with the 18-foot estimate of the latter report; the Chief of Engineers concurred and the Secretary of War transmitted the report and the subsequent actions and concurrence to Congress. There the matter rested till 1915, when it was again brought up in the Rivers and Harbors Committee, and in 1916 Congress authorized a resurvey. This the Secretary of War ordered and work was begun, but the World war prevented its completion, just as it stopped most domestic projects. But a resurvey was being completed as the Board of Conference undertook its task. A report on this survey had not been submitted when the Board made its report to the Legislature, but of one thing the Board was assured—that the War Department would not recommend the improvement of the Bronx kills until the obstructions at High bridge had been removed.

The United States, the State and the city of New York all had a part in the entanglement into which the project as a whole had fallen. A few words will explain the situation. The Barge canal terminal act made the construction of a terminal at the foot of East 136th street, East river, Bronx borough, dependent on the deepening of the Bronx kills by the Federal government. The improvement of the Bronx kills was an affair wholly within the province of National authority, except possibly the ceding of a little land by the State, a detail of easy adjustment, but the Federal government seemed to have determined as a matter of policy that, even if this project were adopted by Congress, no part of the appropriation should become available until the pillars of High bridge ceased to obstruct navigation. This structure belonged to the city and its removal or

alteration was a task for which the city alone was responsible. But the municipal authorities had assumed the position that they would take steps to remove this obstruction only upon the condition that the objectionable bend in Spuyten Duyvil creek should be eliminated. Congress had authorized the War Department to straighten the channel at this place when the State or other parties should have provided the necessary right of way. Shortly after Congress had adopted this project, March 4, 1913, the State attempted to comply with this requirement by enacting a law (chapter 414, Laws of 1913), but unfortunately for the project certain conditions were inserted which made the carrying out of the act impossible.

This was the situation which confronted the Board of Conference when it assumed office, and, as we have said, its task in part was to devise means for untangling the knotted problems. As the string of provisos seemed to end with certain required action on the part of the State, it appeared to be the duty of the State to make the first move, and the appointment of this Board was in response to such demand. If neither the United States nor the city would recede from its stand, the State was in position, of course, to set the chain of activities in motion by furnishing the desired right of way, but this action was fraught with several difficulties. The land was occupied by a large industrial plant, the Johnson Iron Works, and to remove it or to change it not only would entail large expense but might result in creating conditions which were not at all to be desired. The law, as it stood, limited the State expenditure to one million dollars, and this amount was insufficient to obtain the right of way. Also there was but little general knowledge on the subject and not enough appreciation of the need of the improvement to create public demand for adequate action on the part of the State; hence the Board of Conference and its task of gathering information, of stimulating general interest and of inspiring to action, if possible.

In its study of the Harlem project the Board made trips of inspection, had numerous conferences with Federal and municipal authorities and officials of interested corporations and held public hearings in the boroughs of Manhattan, Bronx and Queens. While considerable that was said on these occasions, at the hearings in particular, did not add materially to the fund of information, except to show personal desires for the improvement, the essential facts were brought out.

It appeared from the testimony of boatmen and shippers that two of the pillars of High bridge were a menace to navigation of such

hazard that their removal was a positive necessity. Nearly all were agreed upon this subject, although some objectors were found to advocate the keeping of this ancient bridge. The attitude of the latter people, however, was characterized by their opponents as sheer sentimentality. The structure had served its original purpose and was then so little used that it could easily be dispensed with. It would cost nearly a half million dollars to make such alterations as would do away with the obstructing pillars while still retaining the bridge. To remove the structure entirely, on the other hand, would cost substantially nothing, since the salvage of materials would about equal the cost of demolition.

The Johnson Iron Works, it was learned, represented an investment of about ten million dollars and gave employment to seven or eight hundred men. Its market was in near-by places in the city and a suitable new location was not at hand. The United States engineers' plan for cutting through this plant was costly and contained objectionable features. Other plans were presented to the Board by private individuals, but they either were unsatisfactory or involved more expensive construction than the Federal plans. Also the question of suitable rail connections brought the railway company into the controversy.

As to the advisability of the project, it was shown that the region which would receive large, direct advantage, the boroughs of Bronx and Queens, constituted a considerable portion of the population and wealth of the state and so its claim to share in the benefits of water transportation was entitled to serious consideration. Moreover, this section had developed amazingly in the last few years and natural conditions were favorable for improvement and growth of still more vast proportions. The water-front of this region stretches for many miles and steamship companies were planning accommodations for world-wide shipping. Industrial sites were available and there was bright promise, so the residents of the boroughs thought, that this territory would become one of the largest manufacturing centers of the entire country. New York city as a whole would also be greatly benefited and since it paid about three-quarters of all State expenditures its needs could not be neglected.

In submitting its report to the Legislature the Board of Conference recommended such action as was necessary to secure the completion of the Harlem river project and the prosecution of the Bronx kills project, enterprises which the Board considered as highly needful adjuncts to the State waterway system. It called attention to a statement in the 1919 annual report of the Chief of Engineers of

the United States Army, in which the traffic on the Harlem in 1917 was given as 15,822,342 tons, valued at \$1,788,331,171, and 2,642,908 passengers. In this same report the Chief of Engineers said that he submitted no estimate of funds for prosecuting the Harlem river work because it was believed that the obstruction should be removed before any further work was done. Commenting on this statement the Board of Conference declared that no better argument for the urgent necessity of action was needed, and it added, speaking particularly of High bridge, "It is, therefore, quite evident that the project for the improvement of this inland waterway, inaugurated in 1878 and now after 42 years only 58 per cent completed, will never be finished until this obstruction to navigation is removed."

In detail the recommendations of the Board included the following five main items:

(1) In order to clear the way for straightening the channel at the Johnson Iron Works, the State law which had attempted to make provision for acquiring the right of way should be amended by making certain specified changes, one of them being an appropriation of sufficient amount to carry out the United States engineers' plan of alterations. As this sum would exceed one million dollars, resort must be had to a referendum to the people at a general election.

(2) The city of New York should proceed at once to remove the obstructions to navigation at High bridge, either by taking it down entirely or by reconstructing it so as to eliminate the two obstructing pillars. Moreover, the Legislature should require assurance from the city authorities that such action would be taken before any law for acquiring the right of way at Johnson Iron Works should be enacted. The Board was able to report, however, that there was every reason to expect that the city administration intended to act in coöperation with the State and Federal governments and see to it that High bridge ceased to obstruct navigation.

(3) When the city had given assurance that the High bridge obstruction would be eliminated and the Legislature had made possible the acquisition of the necessary right of way for straightening the channel at Johnson Iron Works, the Secretary of War and the Speaker of the House of Representatives should be notified of such action and requested to take steps promptly for beginning the improvement of the Bronx kills.

(4) The fourth item dealt with a subject concerning which we have merely hinted in our discussion — the railroad problem at the western end of the proposed waterway. The recommendation was that, in any settlement that might be made of the so-called West

Side problem, the city authorities and the Secretary of War should be urged to give due consideration to the necessity of reëstablishing the grade of the New York Central tracks at Spuyten Duyvil so that they would pass over the Harlem on a drawbridge with at least 24 feet clearance at high tide or pass through a tunnel under the river.

(5) As soon as appropriate steps had been taken to straighten the bend at the Johnson Iron Works, to remove the obstructions at High bridge and to widen and deepen the Bronx kills, the State Canal Board should proceed to provide a Barge canal terminal at 136th street, East river, borough of Bronx.

It may be added that at last the completion of the Harlem river improvement seems to be on its way toward attainment. The Legislature of 1922 (by chapter 407) appropriated \$1,500,000 for purchasing the necessary right of way, and the city has taken the first steps to remove the obstructions at High bridge. It will be noticed that the Legislature made provision for the work by direct appropriation rather than by a referendum, such as the Board of Conference thought would be necessary.

CHAPTER XXI

THE CHIEF BUILDERS AND THEIR ASSISTANTS

The State Engineer the Chief Builder—His Duties—List of State Engineers—Mr. Bond's Place in Barge Canal History—Mr. Williams' Preëminence among the Chief Builders—Mr. Van Alstyne's Important Work in Early Plans and Policies—His Chief Assistants—Mr. Skene's Work—His Chief Assistants—Important Undertakings Started during Mr. Williams' First Term—His Chief Assistants—Changes Made and Work Begun by Mr. BenseL—Large Amount of Construction during His Term—His Chief Assistants—Completion of Canal and Addition of New Features during Mr. Williams' Second Term—His Chief Assistants.

IN THE scheme of Barge canal construction the State Engineer has been the official who has carried most of the responsibility for the accomplishment of the enterprise. He has not always held so prominent a place in canal affairs. In the earlier days he shared with the Superintendent of Public Works the duty of supervising works of construction, but this form of divided responsibility was most severely condemned by the investigators of the nine-million-dollar canal enlargement and certain experiences of that ill-fated project led the framers of the Barge canal law to place in the hands of the State Engineer the task of both planning and constructing the new waterway.

Thus the State Engineer became the chief builder of the Barge canal. It was his duty to decide just how the canal should be built, where within specified limits the channel should run, where the structures should be placed and what should be their character, and after these and numberless other decisions were made and had taken on the form of approved plans it was his further duty to see that the contractors built the canal according to these plans or according to such revisions as he should make to meet the contingencies that might arise. The State Engineer, however, was not clothed with autocratic powers; his plans, his revisions, his extra work orders and various other of his activities had to be approved by the Canal Board—a board of which he himself was a member; the consulting engineers constituting the Advisory Board had little real authority at first and never very much, but by their advice and their easy access to the public ear in case they desired to criticise they wielded considerable power; the Superintendent of Public Works awarded

STATE ENGINEERS

1900-1922



EDWARD A. BOND
1900, 1901, 1902, 1903,
1904



HENRY VANALSTINE
1905, 1906



FREDERICK SENE
1907, 1908



JOHN A. BENZEL
1909, 1910, 1911, 1912

FRANK M. WILLIAMS
1909, 1910, 1911, 1912,
1913, 1914, 1915, 1916,
1917, 1918, 1919, 1920,
1921, 1922

the contracts and his warrant was the instrument which authorized payments to the contractors; together these two officials accepted completed work; other State officers too had their several parts to do. But naturally the problems of a project essentially engineering in most of its aspects fell to the lot of the only engineer among the responsible officials, and in the end the State Engineer had to shoulder most of the obligation for the proper planning and conduct of the work.

We are interested then in knowing who are the men that have held the office of State Engineer during the construction of the Barge canal — who are these men to whom credit is due for building one of the great engineering works of the world. That this is one of the great engineering works of the world there can be no question. Whatever may be one's opinion of the economic value or the expediency of this or any other canal, or whatever may be one's view as to the best type of canal, if any, for this particular location, there can be no doubt of the high standing of the Barge canal as a work of engineering.

There have been five men to hold the office of State Engineer since the autumn of 1903, the time when the plebiscite was given for building the canal. These are Edward A. Bond, Henry A. Van Alstyne, Frederick Skene, Frank M. Williams and John A. Bensel. But the first one named in the list can scarcely be enumerated among the chief builders. Mr. Bond resigned the office of State Engineer to assume the chairmanship of the Advisory Board so soon after construction was authorized, even before the making of contract plans was more than begun, that we shall not include him in our discussion of the chief builders of the canal.

Mr. Bond, however, occupies a unique place in Barge canal history. He was a member of the committee which after thorough investigation gave to the State its Barge canal policy. He directed the preliminary survey and rendered a report on it which became a model of its kind and a text-book for similar projects. He was responsible for the preliminary estimates, which have been characterized even by a bitter political opponent as being so accurate "that seldom if ever has a work approximating the magnitude of the Barge canal improvement been carried to completion at a final cost for construction so near to that originally estimated" as was the case of the Barge canal. He was chairman of the Advisory Board of Consulting Engineers, a body which for the first seven years of Barge canal construction was accorded by the courtesy of general practice an authoritative supervision over canal planning and building.

Among this list of names there is one which stands out above the others, that of Frank M. Williams. If for no other reason Mr. Williams would be entitled to distinction for his long service. At the close of his present term he will have served as State Engineer for ten years, two years longer than any other incumbent since the Constitution of 1846 created the office. But the length of Mr. Williams' administration, although it extends over more than half the construction years, is not its chief claim to honor. The momentous problems solved under his direction, especially the all-important question of adding terminals to the canal project, and also the periods of his control, both in the early stages and in the years of completion, when the country was struggling with war or its aftermath, have made Mr. Williams preëminent. It is he, therefore, whom history will acclaim the builder of the new waterway; it is he who will be known as the DeWitt Clinton or the Colonel Goethals of the Barge canal.

In reviewing the administrations of the several chief builders of the Barge canal we do not find many sharp distinctions of procedure or radical changes of policy, such as might be found in an enterprise administered by officials selected by other than popular elective methods, such for example as actually did occur in constructing the Panama canal, on which the chief engineers were changed for the very purpose of carrying out new policies and different methods.

It was no easy task to form an organization for so large an undertaking as the Barge canal. It was still more difficult to establish precedents, fix standards, institute studies and do the numberless first things in such a manner that the great work should start in orderly fashion and continue without the prospect of many changes of policy in the future. It is a tribute to the thoroughness and foresight of the first chief builder, Mr. Van Alstyne, that in general his policies were continued throughout the whole work and that but few errors needed correcting.

We may enumerate a few of the achievements of Mr. Van Alstyne's administration, and we shall do little more now than name them, since they are described at length in the chapter on early policies and methods. Several very important matters came before him for consideration or decision. Probably the most important was the change in lock width, an increase from twenty-eight to forty-five feet. It was upon his suggestion that the Legislature authorized this change, and it has proved to be a change far-reaching in its results. To prepare the first specifications was also an important

task and moreover there is one particular feature in them which does Mr. Van Alstyne much credit — the elimination of the classification of excavated materials. Among other policies of Mr. Van Alstyne's choosing may be mentioned the substitution of movable for fixed dams in the Mohawk river, the use of concrete in nearly all structures in preference to cut-stone masonry and the selection of test contracts to determine at the beginning the probable cost of the whole enterprise. Under Mr. Van Alstyne the most important of the changes in route and plan were made. These included a new location at the eastern end of the Erie canal, the selection of route which resulted in the remarkable series of high lift locks in the short stretch of land line between the Hudson and Mohawk rivers in the vicinity of Waterford; also a new route which began with a contemplated short change of alignment at Savannah and expanded into a long and radical variation, including eventually a new branch in the canal system. The new grade for the Tonawanda-Lockport level was determined at this time. In addition Mr. Van Alstyne made the first survey for the new Cayuga and Seneca canal and instituted the study which brought Federal coöperation for the channel from Troy to Waterford.

Mr. Van Alstyne had as his Special Deputy Henry C. Allen. The Special Deputy State Engineer was the man who was in immediate charge of the whole Barge canal work, the office having been created by the law authorizing canal construction. The three Division Engineers were Charles W. Trumbull on the Eastern Division, Charles O. McComb on the Middle Division, and A. J. Rockwood on the Western Division.

Mr. Skene's administration was the shortest of any during Barge canal building, only two years, 1907 and 1908. The period was early in the enterprise, before construction had really got under full headway and also before certain, new, all-important features arose, and yet after the main questions of policy and methods had been decided. There were a few circumstances of importance, however, in Mr. Skene's time. He was the first State Engineer to bring the need of terminals prominently before the people and to recommend that these most necessary adjuncts be included in the canal scheme. He joined forces with the Deeper Hudson advocates and also pushed with vigor the plan of his predecessor to secure Federal assistance for the Troy-Waterford section. It was Mr. Skene who began publishing the *Barge Canal Bulletin*, and the studies made under his guidance included those for the Syracuse harbor, the movable dams at

Rochester and Phoenix and the troublesome and complex route through Rome.

Mr. Skene's Special Deputy was William R. Hill, a man who had made a name for himself as the chief engineer of the Syracuse water works. As Division Engineers there were J. F. Creeden for a short time and then L. B. Harrison on the Eastern Division, Henry B. Brewster on the Middle Division and John P. Kelley on the Western Division.

It should be remembered that both Mr. Van Alstyne and Mr. Skene had charge of State highway construction as well as the building of the Barge canal, and the highway work had grown to large proportions by that time. A poll of the engineers under Mr. Skene on both canal and highway projects would have shown a corps of about eighteen hundred men. Soon after Mr. Skene's administration the highways were transferred from the State Engineer's department to a special commission, but it was during Mr. Skene's term that action was taken to effect this change.

During Mr. Williams' first term, 1909 and 1910, several important things happened, the most important being the appointment of a Terminal Commission, a body of which Mr. Williams was chairman. This Commission made an exhaustive study of the whole terminal question and rendered a report which, it may be said incidentally, stands at the top of terminal literature, but it also did that which was of greatest import to the State, it gave a new canal policy, no less a policy indeed than one for adding to the original canal scheme the feature upon which the success of the whole project mainly depends.

Second in importance of the events of this administration was the adding of the Cayuga and Seneca canal to the Barge system. The first survey for this branch had been made under Mr. Van Alstyne, but early in 1909, after lying quiescent since 1905, the project came to a head and before the year closed the preliminary surveys and estimates had been made and the scheme had received, first legislative approval and then popular authorization at the polls, and prior to his retirement at the close of 1910 Mr. Williams was able to prepare contract plans and put the first contracts in force.

Another piece of work which Mr. Williams instituted was what is known in canal parlance as the "blue line" surveys. The time was at hand when much would have been lost to the State by way of property values and to its citizens by way of information relating to considerable private property, had this work not been undertaken.

It was fortunate that there was serving the State at this particular juncture a man with Mr. Williams' long familiarity with State engineering affairs as well as his breadth of vision to appreciate the necessity of the case.

During this administration there came also Federal aid for the Troy-Waterford section, important decisions affecting railroad crossings, a series of tests for the proposed Medina aqueduct and the first recommendation relative to charting new canal waters.

Mr. Williams selected his chief assistants from among those who like himself had been long in the State Engineer's department and were thoroughly familiar with the problems which would confront them. William B. Landreth served as Special Deputy, while the Division Engineers were George D. Williams for the Eastern Division, Guy Moulton for the Middle Division and Thomas W. Barrally for the Western Division. It will be recalled that Mr. Landreth had been prominent in the preliminary Barge canal survey and had had charge of such work as had been done between the time of popular ratification of the project and the appointment of the first Special Deputy State Engineer.

Mr. Bensel came to the office of State Engineer with the prestige of having been at the head of other large engineering works and of being at that time the President of the American Society of Civil Engineers. For the first time in many years the Democratic party was coming into full control of the State government and changes were rife. Mr. Bensel himself was not in accord with various acts of his predecessors, and being a man of pronounced opinions and direct address, he did not hesitate to criticise and to change where he saw fit.

Prominent among the changes was the abolition of the Advisory Board of Consulting Engineers, accomplished of course by legislative act but done at the State Engineer's suggestion. In place of this board the State Engineer was permitted to employ, with the approval of the Governor, one or more consulting engineers.

One of the first things to take Mr. Bensel's attention was the problem of railroad crossings. This feature of the work he regarded as having been particularly slow in progress and wrong in management. What he did in carrying out his ideas, however, resulted in throwing the affair into the courts. It remained there till the last year of his administration and then a decision was rendered which upheld the action of the former administrations. Another change attempted by the State Engineer met with no better success. The

authority of Federal control over the waters of the Hudson at Troy was questioned and attempt was made to stop Government construction at the Troy lock and dam, but without avail.

At certain places Mr. Bensel found it advisable to make changes in structural designs. The most notable of these were the substitution of pneumatic-caisson for coffer-dam methods in building the lock and dam at Scotia and the use generally of heavier steel construction, including the strengthening of bridge superstructures at the Mohawk river movable dams.

Construction of canal terminals was begun under Mr. Bensel and considerable progress was made during his term of office. This was the outstanding new venture of his time. The policy he instituted of waiting for traffic to demonstrate its need of certain facilities before attempting to supply those facilities has remained the accepted policy throughout terminal construction.

This was the time of the Commission on Operation and Mr. Bensel served on that body. It was also the time of the serious break at Irondequoit creek, for the repair of which speed and resourcefulness were demanded. In this administration Congress was induced to extend the Lakes Surveys to cover the navigable natural streams of the Barge canal system, thus assuring Federal charts for these waters. The need of making legislative provision for the disposal of old canal lands abandoned by reason of new alignments was a subject of Mr. Bensel's propounding.

The years of Mr. Bensel's administration, 1911 to 1914, both inclusive, were the years of largest accomplishment in the amount of canal work done. Measured in money values about half of the work was done during these four years. But this fact does not entitle Mr. Bensel to unusual credit nor detract from the honor due to the other chief builders. It was to be expected that the middle period of construction would be the most active.

In choosing his principal assistants Mr. Bensel did not bring many new men into the department. Some of his earlier appointments were from among the existing corps and all of his later selections were from that source. Alex. E. Kastl was Special Deputy, John A. O'Connor and Edwin Styring were promoted to be Division Engineers of the Eastern and Middle Divisions, respectively. Edward J. Govern was the Western Division Engineer. When terminal construction began Mr. O'Connor was placed in charge, having the title of Terminal Engineer. To fill the vacancy thus made, Dwight B. LaDu was promoted to Eastern Division Engineer.

Two Division Engineers for terminals were appointed, Carleton Greene for the Southern Division and Guy L. Noble for the Middle Division, both of them being elevated from lower ranks. On August 1, 1914, Mr. Kastl resigned as Special Deputy and Mr. LaDu was appointed to the position. Thus again the office of Eastern Division Engineer was vacant and R. G. Finch was promoted to fill it. On April 1, 1914, Mr. Govern resigned as Division Engineer of the Western Division and Friend P. Williams was appointed to the vacancy, this also being a promotion. As Consulting Engineers there were appointed George S. Greene, Jr., William H. Burr, T. Kennard Thomson, Mortimer G. Barnes and Joseph Ripley. Mr. Barnes and Mr. Ripley had been members of the Advisory Board of Consulting Engineers. Mr. Ripley was the only Consulting Engineer employed full time for canal work.

Mr. Williams began his second administration under most unpropitious circumstances. The canal was not completed, the appropriation was over-obligated by the contracts then in force and funds were actually so nearly exhausted that all work must stop within a few months unless additional money should be forthcoming.

Mr. Williams' task was to finish the canal and to do this as quickly as possible in spite of many handicaps and the numberless loose ends and last things that might be expected, necessarily perhaps, in an enterprise of such magnitude.

Early in the administration the separate terminal organization was abolished and the whole work, on both canal and terminals, was supervised by one and the same set of officials.

One of the chief things to engage Mr. Williams' attention after the way was cleared to getting additional funds was the Rochester problem. Here, as we have seen, there had been endless discussion without getting satisfactory results, but by the time the new appropriation was available construction could be started in accordance with plans acceptable to both the State and the citizens of Rochester.

Among the questions to be solved early in this administration were those relating to the larger types of navigation aids, such as lighthouses, lake buoys and the like. Then too there was the troublesome and seemingly endless problem of railroad crossings. Soon there came the necessity of completing the canal while contending against the almost insuperable difficulties of war-time restrictions and delays, and with this need came also the incentive to overcome in spite of all odds. The story of this achievement we have already heard and this alone would make Mr. Williams' administration memorable.

With the war new duties devolved upon the chief canal builder. There was a State Council of Defense, of which the State Engineer was a prominent member. In modern warfare the engineer has a large place and so the engineer in the Council of Defense was an important personage. Mr. Williams played a large part also in inducing the Federal government to take over and operate the canal he had finished under such trying circumstances.

Among new canal features to appear in Mr. Williams' administration are the Hudson river terminals, two special bridges over the canalized Mohawk, at Rexford and Scotia, the latter being an unusual structure, and the grain elevators at New York city and Oswego. Elevators stand next in importance to terminals in the list of canal adjuncts, and with the adding of both of these two essentials to the Barge canal project Mr. Williams' name is inseparably and most prominently linked.

Now that there has arisen strong agitation for a rival waterway, a ship canal to the Great Lakes, an impracticable dream as viewed by New Yorkers, Mr. Williams has been in the forefront of opponents to this scheme, which, to say the least, has turned away from the Barge canal the thoughts of those living west of the state, so that they are not inclined to give the New York waterway a fair trial.

At the beginning of Mr. Williams' present administration his Special Deputy was Dwight B. LaDu, who was retained from the preceding administration. The Division Engineers were George D. Williams and Guy Moulton for the Eastern and Middle Divisions, respectively, both of them having served in the same positions during Mr. Williams' first administration. The Western Division Engineer was Friend P. Williams, also retained from the preceding administration. In the fall of 1918 Mr. LaDu resigned. He was succeeded on January 1, 1919, by Friend P. Williams, the work of the Special Deputy having been assumed during the interim by William B. Landreth, Deputy State Engineer. During the war Division Engineer George D. Williams entered the service and while he was absent his work was performed, first by L. C. Hulburt and later by Russell S. Greenman, Mr. Hulburt acting till January 1, 1919, when he was appointed to fill the vacant position of Western Division Engineer. On September 1, 1919, E. D. Hendricks was made Eastern Division Engineer, George D. Williams having resigned. In the early summer of 1921 Friend P. Williams resigned as Special Deputy and thereafter such canal and terminal supervision as remained was assumed by R. G. Finch, Deputy State Engineer.

As Consulting Engineers Mr. Williams has had Henry C. Allen, Elmer L. Corthell, E. E. Haskell, E. C. Moore, Joseph Ripley, Henry Goldmark and William B. Landreth. During the early years of the administration Mr. Ripley gave all his time to the work and in the later years Mr. Landreth has done the same; the others were employed only occasionally. For consultation on terminal work, B. F. Cresson, E. P. Goodrich, H. McL. Harding and Maurice W. Williams have been employed on various occasions. In addition three others have acted in a consulting capacity for special work — B. A. Davis in concrete arch construction, H. R. Wait in grain elevator design and C. C. Egbert in electrical work. Mr. Egbert has acted as expert electrical advisor during most of the canal construction period.

CHAPTER XXII

OFFICIAL MACHINERY

Canal Board: Its Powers and Duties: List of Members during Barge Canal Construction—Advisory Board of Consulting Engineers: Its Peculiar Office: Its Duties: Its Members—Comptroller: His Duty in Issuing Bonds: His Duty in Auditing Accounts and Issuing Warrants for Payments—Attorney-General: His Duties as Legal Advisor to Canal Board and Defender of Claims against State—Superintendent of Public Works: His Duties in Awarding Contracts, Approving Alterations, Making Payments, and Appraising and Securing New Lands: His Membership on Important Canal Bodies: His Duty in Maintaining Navigation—State Engineer and Surveyor: His Duties: His Organization: His Membership on Important Canal Bodies—Special Examiner and Appraiser of Canal Lands: Creation of the Office: Duties and Usefulness of the Appraisers: List of Men Holding the Office.

WHILE the construction of the Barge canal in the main was a work of engineering and most of it fell under the care of the State Engineer and his staff of assistants, there were several other State officials who in one way or another had vital association with the enterprise and performed certain important duties connected with its accomplishment. It is our purpose in the present chapter to mention these officials and describe briefly the parts they played, and also in connection with these descriptions to give the names of the several individuals who held the offices during the period of canal construction. Frequently in the present volume the officials are mentioned by name of office only, especially in the case of bodies composed of several persons, and so these lists are added, that they may be at hand for easy reference, if one desires to know who were the persons involved in various acts.

CANAL BOARD

The chief governing body in supervising all canal affairs in the state is the Canal Board. This Board was established in 1826, only one year after the completion of the original Erie canal, and ever since then it has exercised this power of general control. The Barge canal act did not abridge its powers, if anything it increased them, and it specifically defined the duties with reference to the new work in such fashion as to give it final control, no individual officer being

allowed, without the Board's approval, to go beyond certain well-defined and safe limits. In a former chapter we likened the Canal Board to a board of directors of a great corporation in which the people of the state are the stockholders. The figure seems peculiarly appropriate to apply to this body.

In the course of construction, after plans and estimates had been made, they had to be approved by the Canal Board before contracts could be let and subsequently no alterations that would increase the cost of the work could be made without its consent. No contract could be awarded on a proposal that exceeded the estimate by more than a fixed amount and also no single item of work during construction might overrun the estimate by more than a small percentage without the Board's approval and in the latter instance the Board might determine to have the excessive work done by the Superintendent of Public Works or under a special contract rather than by the original contractor. The Board had power to suspend any contract upon which construction was not progressing in a satisfactory manner and to direct the Superintendent of Public Works to proceed with the work or to order it relet to another contractor. The approval of the final account, after contract work was completed and accepted, also devolved upon the Canal Board.

The Canal Board is composed of seven State officers, six elective and one appointive. They are: Lieutenant-Governor, Secretary of State, Comptroller, Treasurer, Attorney-General, Superintendent of Public Works and State Engineer and Surveyor.

The first five officers named constitute the Commissioners of the Canal Fund — a body whose existence antedates the Canal Board by nine years, having been created by the act which authorized the building of the original Erie and Champlain canals. As the name signifies these commissioners are intrusted with supervision of the canal fund.

The men who have been members of the Canal Board since 1903 and the years of their incumbency are as follows: Lieutenant-Governors: Frank W. Higgins, 1903 and 1904; Matthew Linn Bruce, 1905 and 1906; Lewis Stuyvesant Chanler, 1907 and 1908; Horace White, 1909 and until October 6, 1910; Thomas F. Conway, 1911 and 1912; Martin H. Glynn, January 1 to October 17, 1913; Edward Schoeneck, 1915, 1916, 1917 and 1918; Harry C. Walker, 1919 and 1920; Jeremiah Wood, 1921 and 1922, till September 26.

Secretaries of State: John F. O'Brien, 1903, 1904, 1905 and 1906; John S. Whalen, 1907 and 1908; Samuel S. Koenig, 1909 and 1910;

Edward Lazansky, 1911 and 1912; Mitchell May, 1913 and 1914; Francis M. Hugo, 1915, 1916, 1917, 1918, 1919 and 1920; John J. Lyons, 1921 and 1922.

Comptrollers: Otto Kelsey, November 12, 1903, to November 8, 1906; William C. Wilson, November 8, 1906, to December 31, 1906; Martin H. Glynn, 1907 and 1908; Charles H. Gaus, 1909 till his death in November; Clark Williams, November 12, 1909, to December 31, 1910; William Sohmer, 1911, 1912, 1913 and 1914; Eugene M. Travis, 1915, 1916, 1917, 1918, 1919 and 1920; James A. Wendell, 1921 and 1922 till his death on May 10; William J. Maier, 1922, beginning in May.

Treasurers: John G. Wickser, 1903 and 1904; John G. Wallenmeier, Jr., 1905 and 1906; Julius Hauser, 1907 and 1908; Thomas B. Dunn, 1909 and 1910; John J. Kennedy, 1911, 1912, 1913 and 1914 till his death in February; Homer D. Call, February 25 to December 31, 1914; James L. Wells, 1915, 1916, 1917, 1918, 1919 and 1920; N. Monroe Marshall, 1921 and 1922.

Attorneys-General: John Cunneen, 1903 and 1904; Julius M. Mayer, 1905 and 1906; William S. Jackson, 1907 and 1908; Edward Richard O'Malley, 1909 and 1910; Thomas Carmody, 1911, 1912, 1913 and 1914 till September; James A. Parsons, September 2 to December 31, 1914; Egburt E. Woodbury, 1915, 1916 and 1917 until April; Merton E. Lewis, April 25, 1917, to December 31, 1918; Charles D. Newton, 1919, 1920, 1921 and 1922.

State Engineers and Surveyors: Edward A. Bond, 1903 and 1904 till May 1; Henry A. Van Alstyne, May 10, 1904, to December 31, 1906; Frederick Skene, 1907 and 1908; Frank M. Williams, 1909 and 1910; John A. Bense, 1911, 1912, 1913 and 1914; Frank M. Williams, 1915, 1916, 1917, 1918, 1919, 1920, 1921 and 1922.

Superintendents of Public Works: Charles S. Boyd, December 20, 1901, to January 4, 1905; Nicholas V. V. Franchot, January 4, 1905, to January 14, 1907; Frederick C. Stevens, January 14, 1907, to January 4, 1911; Charles E. Treman, January 4, 1911, to January 1, 1913; Duncan W. Peck, January 1, 1913, to January 6, 1915; William W. Wotherspoon, January 6, 1915, to February 3, 1919; Lewis E. Nixon, February 3 to May 3, 1919; Edward S. Walsh, May 3, 1919, to January 19, 1921; Charles L. Cadle, January 19, 1921, to —.

ADVISORY BOARD OF CONSULTING ENGINEERS

The board of advisory engineers was created by the Barge canal act. The members were appointed by the Governor and in this particular the board did not differ greatly from other bodies

similarly appointed. But really there was a somewhat intimate relationship between the Governor and this board, perhaps not so much expressed in the law as implied, the outgrowth of a widespread feeling that because of the immensity and importance of the undertaking the Governor should keep his hand upon it through these carefully-selected expert engineers, who should be answerable only to himself. The board made its annual reports directly to the Governor. There was a feeling abroad too that there should be some continuing body, removed from the reach of party politics, that would preserve a unity of plan and operation in canal construction during changes which might occur in the coming of new administrations. When the Barge canal project had been presented to the people, great stress was laid upon this board, for both its permanency and the high order of ability and character of the men who should be appointed.

Under the creating statute the duties of the board were strictly advisory and it had no authority by law to compel acceptance of its suggestions. As a matter of fact, however, its opinions were almost always treated with as much respect as if they had legal weight. Nearly every question of moment concerning the new canal was submitted to the Advisory Board and also persons who had suggestions to make or grievances to register appeared before this Board just as they appeared before the Canal Board for like purposes. Even before the law directed such action it was customary to submit plans, specifications and estimates to the Advisory Board before they went to the Canal Board and whatever changes the advisory engineers suggested were made before the plans were ever sent to the Canal Board for approval.

Two amendments to the Barge canal law had to do with defining the duties of the Advisory Board in certain particulars. The first, passed in 1907, made it mandatory on the State Engineer to submit both contract plans and alterations to the Advisory Board before sending them to the Canal Board. The second, passed in 1908, required the State Engineer to send copies of appropriation maps to the Advisory Board before they were submitted to the Canal Board. In each instance the Advisory Board was directed to make examinations and reports on the subjects submitted. It was necessary, therefore, for the advisory engineers to keep in close touch with all the work of construction, both prospective and actual. This was the more necessary because of the stand the Superintendent of Public Works took of not paying the monthly estimates until a majority of the advisory engineers had made a certificate attesting the satisfactory character of the work performed.

A statute of 1904 provided that the terms of office of the advisory engineers should continue during the construction period of the improvement, but an act of 1911 terminated the Board and this took effect on July 21, 1911.

At the beginning of its existence, early in 1904, the Advisory Board consisted of Edward A. Bond, chairman, William A. Brackenridge, Elmer L. Corthell, Alfred Brooks Fry and Thomas W. Symons, and during its life there were but two changes in membership. On July 31, 1907, Mortimer G. Barnes took the place of Dr. Corthell, resigned, and on November 5, 1909, Joseph Ripley replaced Mr. Brackenridge, also resigned.

There are four State officials who, aside from their duties as members of the Canal Board, have had much to do with canal construction by reason of responsibilities imposed upon them as individual officers. These are the Comptroller, the Attorney-General, the Superintendent of Public Works and the State Engineer and Surveyor.

COMPTROLLER

The Comptroller's main duties in connection with the canal have been two in number—to take charge of issuing State bonds for raising funds and to audit accounts and issue warrants for payments. The Comptroller's connection with the bond issue extended from the time the blank paper was received to the time the funds were paid in. The paper for the bonds, especially water-marked, was delivered to the Comptroller under a certified double count. He delivered a sufficient number of sheets to the engraver for each issue, getting a receipt for them. After the engraving, the paper was fully accounted for, either in actual bonds or in imperfect or blank sheets. Then after the bonds had been carefully examined and the signature and seal of the Comptroller had been affixed, they were sent to the State's transfer office, a certain banking house in New York city, for counter signature. Next the Comptroller advertised the sale of the bonds and awarded them to the successful bidder or bidders. Then the transfer officer, upon the receipt of payment, placed the money to the credit of the Treasurer of the State in the account of the canal fund.

Upon the Comptroller devolved the duty of auditing the accounts of all moneys expended for Barge canal purposes. These included the payments to contractors, payments for engineering expenses, payments for permanent appropriations of land and for damages thereto, the expenditures of the Advisory Board of Consulting

Engineers and of the Special Examiner and Appraiser for the purchase of lands, and various miscellaneous expenses incidental to the work of constructing the canal. Advances were made for engineering expenses to the division engineers of the State Engineer's department and abstracts of expenditures with accompanying vouchers were presented monthly and duly audited by the Comptroller. Accounts and vouchers were presented by the Superintendent of Public Works for miscellaneous expenditures, together with his draft, and these drafts were paid from the treasury upon the warrant of the Comptroller. Monthly estimates were prepared by the resident engineers and approved by the division engineer, the State Engineer and the Advisory Board of Consulting Engineers (while that body was in existence) for the work of construction on each of the contracts, and drafts were issued by the Superintendent of Public Works on the Comptroller and payment of each draft was made by the Treasurer's check, issued on the warrant of the Comptroller after due audit of each estimate by him. The payments for lands acquired either through judgments of the Court of Claims or by agreements entered into by the Special Examiner and Appraiser, as well as all other miscellaneous payments incidental to construction, were made, upon the rendition of accounts and vouchers in due form, by the Treasurer's check, issued upon the warrant of the Comptroller. The organization in the Comptroller's office to care for this work is the Bureau of Canal Affairs.

The names of the men who have held the office of Comptroller since Barge canal work began are given in connection with the list of members of the Canal Board.

ATTORNEY-GENERAL

The Barge canal law placed on the Attorney-General the duty of approving the form of contract under which work should be let and also the form under which security should be given by a contractor for the faithful performance of such work. If this had been his only duty his connection with the waterway would have been of little consequence, but as legal advisor of members of the Canal Board there fell upon him an important part in the work of canal improvement. In the letting of contracts and the construing of their terms, in appropriating lands and waters and in legal questions that have arisen during the whole progress of construction the advice of the Attorney-General has often been sought. But by far the major part of his service has consisted in defending claims brought against the State in the Court of Claims for damages alleged to have been sustained by reason of the Barge canal or its construction.

For several years the Court of Claims was engaged almost exclusively in disposing of Barge canal claims. Many millions of dollars have been involved and the responsibility resting on the Attorney-General has been great. Two especially important questions entered into several of the claims—the rules for the valuing of water-power and a decision as to what constitutes riparian rights—questions which, although considered in original canal construction, might still be treated as open to settlement by the highest courts.

The men who have held the office of Attorney-General since the Barge canal law was passed, are also listed among the names of Canal Board members.

SUPERINTENDENT OF PUBLIC WORKS

The official who aside from the State Engineer has had closest connection with Barge canal construction is the Superintendent of Public Works. While the Superintendent had nothing to do with making contract plans, his relation to the plans after they were prepared was very intimate. As a member of the Canal Board he had a voice in their approval. Since, however, only two members of the Canal Board, the State Engineer and the Superintendent, might be expected to have any technical knowledge of the work, the judgment of these two was generally accepted and followed by the others and from this practice the custom became established of submitting the plans and specifications to the Superintendent for his examination before they were sent to the Canal Board. This arrangement between the two officials was found to work well, for it gave opportunity of adjusting any points of difference before the plans came to the Board for approval.

After plans had been approved by the Canal Board it was the duty of the Superintendent to award the contracts. He advertised the letting in accordance with directions laid down in the Barge canal law, fixed the date on which sealed proposals would be received, opened the bids on the given day and then awarded the contract. In all of this procedure there were many details that entered into the task, such as printing books of instructions to proposers, which contained also bidding sheets and specifications, exhibiting the plans, receiving and caring for the certified checks or drafts accompanying the bids, canvassing the bids, deciding whether they were formal and proper in every respect and determining whether the proposer had apparent resources and ability to perform the contract. After the award the contract could not be assigned or transferred without the approval of the Superintendent.

During the course of construction no alteration might be made in any plan or specification until it had first been approved by the Superintendent of Public Works, the State Engineer's approval having previously been given. Also, should the proposed alteration entail an increase of cost or create a claim against the State, it had to be submitted to the Canal Board for approval.

Payments, both monthly and final, for contract work were made by drafts issued by the Superintendent. Under the law he needed no other authority to warrant him in making payments to the contractors than the certificate of the State Engineer as to the amount and character of the work performed, but deeming it expedient that he should have an engineer in his own department to pass upon estimates and construction work, he appealed to the Legislature and was granted permission to employ an advisory engineer. The Superintendent also took the added precaution of requiring with each estimate of work done a certificate signed by a majority of the individual members of the Advisory Board of Consulting Engineers attesting that the work had been done in accordance with the plans and specifications. In the acceptance of a finished contract the State Engineer and the Superintendent of Public Works were jointly responsible.

The duty of serving papers on the owners of land to be taken for canal construction devolved upon the Superintendent. In addition to the examination and appraisal of such property by the Special Examiner and Appraiser, the Superintendent caused an independent examination to be made and the valuations fixed by the two agents had to agree closely before settlement could be made. After the Special Examiner and Appraiser had agreed with an owner as to the amount to be paid by the State, such agreement had to receive the Superintendent's approval and then the Superintendent presented the matter to the Canal Board for approval. In 1915 a Bureau of Appraisal was established in the Superintendent's department, taking the place of former machinery for acquiring property, and since then the whole of such procedure has been in charge of the Superintendent. Copies of all claims brought against the State in the Court of Claims on account of Barge canal work must be filed in the department of Public Works.

The Superintendent has been a member of nearly all the various boards and commissions that have had to do with canal investigations. At the very beginning he was one of the five men to constitute the Committee on Canals, the body that formulated the Barge canal

policy. On the Terminal Commission he was one of four members. On the Commission on Operation he was supreme, the body being made up of the active Superintendent, two who had formerly held the office of Superintendent, one who had been Deputy Superintendent for a dozen years, and the State Engineer. On the Jamaica Bay-Peconic Bay Canal Board, the Board of Conference on the Gravesend Bay-Jamaica Bay Waterway, and the Board of Conference on the Harlem River Improvement the Superintendent was one of three members in each case. For making the Tonawanda-Buffalo investigation the Superintendent was one of the two appointed. For carrying out the new canal water-power policy the Superintendent has most of the responsibility. He is also a member of the commission appointed to uphold the interests of the State in the St. Lawrence ship canal contest.

The Superintendent of Public Works and his predecessors before him, the Canal Commissioners, have had charge of maintaining navigation on the State canals ever since there have been any canals in New York to navigate. Since nearly all of the canal system has been kept open during the entire period of Barge canal building, the Superintendent, in order to be sure that nothing would interfere with navigation, has had to keep in intimate touch with the actual work of construction, although the State Engineer had charge of it. This has necessitated a close coöperation between the two officials and fortunately for the undertaking such a state has existed. Of course there have been many differences of opinion; it was the State Engineer's duty to build the canal and the Superintendent's duty to maintain navigation and often the two interests conflicted, but a way has always been found out of every such dilemma. Under certain conditions also the Superintendent has acted as contractor, and workmen employed by him have constructed portions of the canal. This has happened on a few small pieces of work, when the Canal Board has exercised its prerogative under the law and has decided to do the work in this manner, but it has happened also on some large pieces of work, the Canal Board again exercising its prerogative and ordering the Superintendent to complete a contract terminated by the Board or on which the contractor had defaulted. After portions of the channel or the canal structures have been completed they have been turned over to the Superintendent and thereafter they are in his charge.

The names of the several Superintendents of recent years appear in the list already given in connection with the Canal Board.

STATE ENGINEER AND SURVEYOR

The chief responsibility for constructing the Barge canal has rested upon the State Engineer. His was the task of selecting the route and showing the feasibility of the canal before the question of its building was brought to final issue. After the project was authorized it was his duty to determine and plan all details of construction and then to supervise the actual work of building. He took the measurements and computed the estimates month by month for paying the contractors and at the end he made the final measurements and estimates for completing the payments. Together with the Superintendent of Public Works he accepted the finished contracts in behalf of the State. This description briefly outlines the State Engineer's connection with the Barge canal, but there has been an almost infinite amount of detail included in this work and it is useless to attempt even an enumeration of its many phases. Perhaps the story can be told most concisely by saying that the State Engineer has done nearly everything needful which has not been recorded in this chapter as the specific duty of some other official.

The State Engineer required a large corps of assistants to carry on this work. The authorizing law made special provision for the directing heads, allowing the appointment of a Special Deputy and additional Resident Engineers. The organization has not remained the same throughout construction, but in general the Special Deputy's office contained the following divisions: Bureau of Designing and General Drafting, Bureau of Locks, Bureau of Rivers, Bureau of Water-supply, Bureau of Bridges, Bureau of Electrical Equipment, Bureau of Hydraulics, Bureau of Computing and Checking, Bureau of Publication and Reports and Testing Laboratory. These bureaus were in charge of Supervising Engineers, special expert engineers and Resident Engineers. During the first four years of terminal construction there was a separate organization for that work. Then it was made a bureau in the Special Deputy's office. In the later years it has been necessary to have a bureau for collecting and preparing material for use in defending claims against the State. Since the cases before the Court of Claims usually hinge on engineering data or questions of fact as recorded in the files of the department, it has come about that the Attorney-General depends largely on the State Engineer to furnish the material for the defense.

For supervising construction numerous residencies were established, with offices at various cities or villages along the canal. All told there have been between 25 and 30 of these residencies, each in charge of a Resident Engineer, or as he is called now, a Senior

Assistant Engineer. Each residency usually covered the work being done under many contracts, and as a rule there was a field office with a corps of assistants for each contract and sometimes several such offices for a single large contract.

In all that has pertained to adding new features or new branches to the canal system the State Engineer has had a part, generally the chief part. He was a member of the Canal Committee that recommended the building of the Barge canal, but he was not the head of this body. The same was true with respect to the Commission on Operation. He was chairman of probably the most important body of all, the Terminal Commission, and also of the Jamaica Bay-Peconic Bay Canal Board, the Board of Conference on the Gravesend Bay-Jamaica Bay Waterway, and the Board of Conference on the Harlem River Improvement. He and the Superintendent of Public Works jointly made the Tonawanda-Buffalo investigation, but the State Engineer presented the report to the Legislature. Of the commission for defending the State's interests in the St. Lawrence ship canal controversy the State Engineer is an important member.

There have been only five men to be State Engineer since agitation for the Barge canal began. A list of their names appears in the chapter dealing with the Chief Builders, also in connection with what was said about the Canal Board in the present chapter and again in the chapter containing lists of Barge canal engineers of the higher grades.

SPECIAL EXAMINER AND APPRAISER OF CANAL LANDS

The Barge canal law made provision for acquiring lands or waters needed for the new canal, but it did not specify any means for making compensation for property taken except through the medium of the Court of Claims. A shorter, simpler and less expensive way was essential, not only for rapid progress but also for the convenience and satisfaction of both State officials and property owners. At the first opportunity after the passage of the original law, therefore, provision was made for the appointment of special agents whose duty it should be to negotiate with owners for settlements without resorting to court proceedings. The Legislature of 1904 (by chapter 335) authorized the Governor to appoint three Special Examiners and Appraisers.

After papers for appropriating lands or structures had been served and maps duly filed, it became the duty of these appraisers to visit the localities, to inspect and make proper examination of the land and also of any buildings which might be on the properties, to

make careful note of their findings in books kept by them for the purpose, to make inquiries concerning the values of properties to be taken, and immediately to begin negotiations for their purchase.

It happened sometimes that agreements could be reached while the appraisers were still on the ground, but in other cases this could be done only after prolonged negotiations and frequent visits to the properties. As soon as an agreement was reached the appraisers executed a contract with the owner and this was submitted to the Canal Board for approval at its next meeting. If the Board did not approve, the contract was returned to the appraisers; if it did approve, the secretary of the Canal Board notified the owner and requested him to forward a deed to the Attorney-General. After search had been made and a satisfactory title proved, the Attorney-General made a certified statement of this fact to the Comptroller, who issued a warrant upon which a Treasurer's check was sent to the owner and the transaction was closed.

It was a fortunate happening that brought about this arrangement for making property settlements. In the course of canal construction it became necessary often to dispossess people of their homes and properties against their wills and the cold and unfeeling processes of the law were repugnant to them. It was the general sentiment that the appraisers were dealing fairly by both the State and the property owners and as a result the people were usually satisfied with the settlements. Some of the owners took their cases to the Court of Claims and of the judgments awarded very few exceeded the figures previously determined by the appraisers. Moreover the settlements effected by the appraisers were much speedier. The Court of Claims was so burdened with cases that long delays were inevitable.

Those who served as Special Examiners and Appraisers were Harvey J. Donaldson, J. Edgar Leaycraft and George Bingham. They held their positions for four years. Then the law which created the offices was repealed and in their stead the Governor was empowered to appoint a single Special Examiner and Appraiser of canal lands. There were three men to hold this office. Harvey J. Donaldson was appointed on May 1, 1908, William B. Milliman on June 28, 1911, and Edwin S. Harris on December 23, 1914. The Legislature of 1915 abolished the office and in its place created in the department of the Superintendent of Public Works a bureau of appraisal to consist of a Special Examiner and Appraiser and such subordinates as the Superintendent deemed necessary, all to be appointed by the Superintendent.

CHAPTER XXIII

SOME ENGINEERING FEATURES

High Rank of Barge Canal as an Engineering Work—General Features of Locks—Siphon Lock—High Lift Lock at Little Falls—Tandem Locks at Lockport—Large Fixed Dams in Mohawk at Crescent and Vischer Ferry—Movable Dams: Bridge Type: Taintor Gate Type: Submersible Sector Gate Type—Siphon Spillway—Automatic Crest on Dam—Concrete Troughs for Carrying Canal—Noteworthy Section near Waterford—Canal and Railroad Construction at Rome—Complicated Situation at Rochester—Interesting Problem at Medina.

“**H**AVING had the opportunity, through the courtesy of the State Engineer, of seeing practically all the main canal and its principal branches,” said a visiting Federal engineer, “I can say without reservation that in no other area of the same extent in the world, including the Panama canal, can an engineer find so much of interest and instructive value in the matter of various types of canalization work. It surprises one after such an inspection that there is not a more general knowledge throughout the country of the canal, its construction and commercial probabilities.” *

Speaking editorially of the *Book of Plans, New York State Barge Canal*, a publication issued by State Engineer Williams particularly for the use of the engineering profession, the *Engineering News-Record* said in its issue of April 28, 1921, “Whatever be the opinion regarding the New York State Barge Canal as an economic factor there can be no doubt of its high standing as a work of engineering. With few exceptions its structures have been models of detail design which may well be set up as standards for future shipping canal work. . . . Too infrequently are the structural records of big projects preserved in such convenient form.”

The high rank of the Barge canal as an engineering work is attested also by many other competent judges. It does not seem necessary in the present volume, however, for the historian to exercise his character as engineer and discourse either at length or in technical phrase on the many engineering achievements of the enterprise. Much has already been written concerning these features,

* Excerpt from letter of Major C. O. Sherrill.

in both professional and popular style, and accordingly there is no need for long repetitions. Moreover for the engineer there is the *Book of Plans*, which often gives in a single drawing what a multiplicity of words cannot so well describe. But this volume would not be complete without at least a brief mention of various engineering features and therefore a few of the salient facts are noticed.

There are 35 locks on the Erie branch of the Barge canal, 11 on the Champlain, 7 on the Oswego and 4 on the Cayuga and Seneca. The standard length of lock chamber is 310 feet at the center, but 10 feet of this is taken up by the concaved lower face of the wall bounding the upper end of the chamber. The distances between gates vary with certain conditions, the least being about 338 feet. The locks are 45 feet wide in general and have 12 feet of water over the sills. The maximum parallelogram which can be passed through all the locks would be 300 feet long by 44.44 feet wide. There are two guard-locks, one on each side of the crossing of the Genesee river. These locks have lift gates, placed 311 feet apart, which are of the same type as the guard-gates. They have the usual width and depth of water, 45 and 12 feet, respectively, but no normal lifts.

The Barge canal locks are built of concrete throughout, both side and cross walls and floor. At a few points, where favorable rock was encountered, the concrete floor has been dispensed with. The side walls are 5, 6 or 7 feet wide at the top, according to local circumstances, and vary in height and bottom width with the lift of the lock and certain other conditions. In some cases, where one side of a lock is exposed to a river channel, the top width is increased to 12 feet. The lifts range from 6 feet to 40½ feet. Both the differences of lift and the fluctuations between normal and high navigable stages govern the heights of the side walls, which vary from 28 feet to 61 feet, with an extreme at one point of the lock at Little Falls of 80 feet. The bottom widths of these walls, which range between 13 and 34 feet, are determined by the height of the walls, the nature of the foundation and certain incidentals of design at each lock. Unless a rock or hardpan foundation could be obtained, piles were driven under practically all locks.

Within each side wall runs a culvert for filling and emptying the lock. The culverts are connected with ports that open into the chamber at the bottom of the walls. These culverts vary in size, the dimensions being 5 by 7 feet for locks of 12 feet lift or less, 6 by 8 feet for lifts between 12 and 23 feet, and 7 by 9 feet when the lift is 23 feet or more. Connected with the 5 by 7 culverts are 16 ports, 8 on either side, while the number is increased to 22 with

the 6 by 8 culverts and 28 with the 7 by 9 size. The ports have been made both by imbedding cast-iron pipes in the concrete and by leaving rectangular openings in the walls, the latter being the later method. The area of opening in either case is about $7\frac{1}{2}$ square feet each.

In some of the locks there is another culvert through one of the side walls — a feature of the hydro-electric development for operating and lighting the locks. Local conditions and the proximity of two or more locks have determined where these power-plants shall be placed. At some points one plant serves several locks, as at Waterford, where a series of five locks and two guard-gates receive power from the plant at Crescent dam.

The lock gates are of the mitering, girder type, carrying the principal load as beams. In general they are built of steel, with single skin-plates, but have white oak quoin and toe posts. The quoin post swings on a cast-steel pivot, set in the concrete, and is held at the top by an adjustable anchorage. The bearing is against cast-iron quoin plates set into the side walls. Wooden gates are employed at three locks.

The lock gates are each opened and closed by a steel spar equipped with a rack, actuated by a 7-horse-power motor acting through a train of gears. This spar is also equipped with a heavy coil spring, to absorb shock. To open or close the gates requires about one minute.

Movement of the gates is controlled from four operating stands, one near each gate. These operating stands are equipped with drum type master switches, by means of which magnet type controllers automatically regulate the acceleration and speed of the motors. Limit switches are provided to arrest the motion of the gates at each end of their travel.

Signal lights indicate to the operator the position of the gates. In the event of failure of power or damage to the motor, it is possible to disconnect the motor and operate the gates by hand by means of sweeps provided for this purpose, which have been so designed that but two men will be required for such operation.

The valves regulating the flow of water in the culverts are suspended on two chains, which pass over chain wheels near the top of the valve wells to cast-iron counterweights. The chain wheels are mounted on a shaft rotated by a motor operating through a train of gears designed to raise or lower the valves at a speed of about six feet per minute.

The motors of the 5 by 7 and 6 by 8 valves are rated at 3 horse-power while those operating the 7 by 9 valves are rated at 7 horse-power.

The movement of the valves is controlled in a manner similar to the movement of the gates and the master switches are located on the same operating stands. Signal lights indicate to the operator that the valves are fully open, two-thirds open, one-third open, or closed. Like the gate machinery the valve machinery may be operated by hand whenever this is necessary or desirable.

Electric capstans, one at each end of each lock, are provided to control the movement of boats along the approach walls and to tow them into and out of the lock chamber. A 20-horse-power motor operates each capstan at a speed of about 60 feet per minute with a pull of 8,000 pounds. The operation of these capstans is controlled by a magnet type controller and master switch located near the capstan.

All the motors incorporated in the lock operating machinery are of the mill type.

In general a power generating station has been installed for each lock. But if two locks are close together, one station suffices for both. In one instance a single station supplies power for five locks. These power stations, constructed of reinforced concrete, 20 by 30 feet in plan and about 20 feet high, are placed adjacent to or near the various locks.

The Barge canal has two or three noteworthy locks. In the city of Oswego there has been constructed a siphon lock — the only lock of this type on the Barge canal, also the first to be built in this country and the largest employing the siphon principle yet built. The general design of the culverts is similar to that of a lock of ordinary type, except that at the upper and lower ends the culverts are curved up so as to form necks, or crowns, which rise a little above the highest water-level and which at the same time are shut off from all communication with the outer air except through the operating pipes. The flow of water is started in the siphons by means of tanks, one being built in each wall near the upper end and communicating through pipes with the upper and lower levels and with both siphons in the same wall and being shut off from all other communication with the outer air. To perform an operation the tank is first filled with water; then the intake valve is closed and the outlet opened. There results a body of water suspended by its weight but tending to escape into the lower pool, thus producing the necessary vacuum. On opening the air valve, air from the siphon rushes into the vacuum

and water begins flowing over the crest in the neck. Using both siphons the lock chamber can be filled in from $4\frac{1}{2}$ to 5 minutes, while it can be emptied in from $5\frac{1}{2}$ to 6 minutes. It has been found that the draft of the siphon is such that soon after the flow has started the direction of the air is reversed and the vacuum is restored in the tank. Thus the operating power is self-renewing and, except for air leakage, lockages can be conducted by merely manipulating the 4-inch air valves.

At Little Falls there has been built a lock notable for its high lift — $40\frac{1}{2}$ feet. The lower gate of this structure is of the lift type — the only instance of lift gate on any Barge canal lock, except the guard-locks at the Genesee river crossing and the upper gate of the Utica terminal lock. Another novel feature at this lock is the side pool. Its purpose is to conserve the water-supply by storing water drawn from the upper half of a chamberful and discharging it to fill the lower half of the chamber at the next lockage. Still another unusual feature at this lock is the masonry across the chamber from side wall to side wall at the lower gate, under which boats must pass in entering the lock from below. At the time of beginning construction this was the lock of highest single lift ever undertaken in the world. This structure takes the place of three locks in the waterway which the Barge canal has just superseded. Before the original State canal was built a private company essayed to improve navigation at Little Falls, beginning work in April, 1793, and using five locks to overcome the fall in the river. As it happens, a lock constructed by this company, although built about seven years later, is still standing. The contrast between these two in such close proximity, the pigmy and the giant of New York canal history, is most striking. An excerpt from a report the directors of this company made to the Legislature in 1796 brings out this contrast. The facts are as interesting as the language is quaint. "Five locks," reads the report, "having each nearly 9 feet lift are placed towards the lower end of the Canal, and the pits, in which they are placed, have been excavated out of solid rock, of the hardest kind; the chamber of each lock is an area of 74 feet by 12 feet in the cleave, and boats drawing three feet and an half of water may enter at all times."

On the earlier State canals the building of two or more locks end to end was not unusual. Combined locks they were called in those days. On the Barge canal there are only two instances of such locks — tandem locks they are now generally termed. The more conspicuous of these is the pair at Lockport. Prior to Barge canal

construction there were ten locks at Lockport, two flights side by side of five locks each. The southerly flight has now been demolished and two locks of Barge canal dimensions have been built in its place. The site of the locks at Lockport, from the time of the original canal to the present, has never changed. The early engineers found the logical location for locks in this vicinity and the same place has been in use ever since. The romance of ancient geological happenings attaches to this site. Where the locks now stand the rushing waters from the Great Lakes once poured, falling over a precipice and excavating the gorge through which the canal passes in its course to the east. In that far-off past this waterfall and gorge, formed by the floods from the interior, were a lesser counterpart of the great Niagara cataract and descended the same declivity, the formation known in geological phrase as the Niagara escarpment.

The two new locks at Lockport have a normal combined lift of 49 feet. At the upper end of the pair there are two sets of gates, one for emergency, since the canal level above extends to Lake Erie and these lock gates and the guard-gate at Pendleton are all that stand in the way of the waters of the lake again rushing over the precipice as in the bygone ages. We shall see in the next chapter that a large volume of water is fed from Lake Erie into the western half of the canal. Much of this supply is carried around the Lockport locks in a tunnel and incidently valuable water-power is created. This is used for manufacturing. It was the creation of power from passing canal waters which brought Lockport into being. Before the original Erie canal was begun there was not even a hamlet where the city now stands, but in less than a year after construction had commenced at this locality a sizable village had sprung up.

Aside from the locks, the dams are usually the most important structures on any canal. On the Barge canal, as well as on modern canals in general, the dams are peculiarly important. This is due to the fact that in the present-day development of waterways it is the practice to canalize the rivers. This condition is particularly true of the Barge canal, which as a whole is distinctively a river canalization.

There are four dams of the fixed variety on the Barge canal which are outstanding because of their size. Two are river dams, located in the lower reaches of the Mohawk, and two are reservoir dams. The dam at the lower end of Mohawk river navigation, called Crescent dam from the name of a near-by hamlet, is situated just below the point where the land line from the Hudson enters the Mohawk. This dam is curved in plan, but is of the gravity type,

not depending on its curved form for stability. This structure is made up really of two dams, with a rocky prominence intervening. One section spans the former river channel while the other crosses low land, which after completion was submerged. The entire structure sweeps through nearly a semicircle on a 700-foot radius, with a total length of 1,922 feet. Across the front of the dam built on the low land was constructed a third dam. This is lower in elevation and its purpose is to maintain a pool which may serve as a water-cushion to break the fall of water spilling over the crest and prevent erosion of the rock at the foot of the main dam. The pool back of the main dam has been raised some 27 or 28 feet above the former river level. This pool spreads out into a virtual lake. Indeed during the ceremonies attending the opening of this portion of the canal on May 15, 1915, Governor Whitman formally christened this body of water Lake Crescent. The crest of this dam stands 39 feet above the apron. At the base it is 42 feet wide and at the top, 11 feet 5 inches. The apron has a width of 40 feet. The masonry content is 54,360 cubic yards. At the eastern end, the end nearest the canal line, is situated the largest power-station as yet constructed on the canal. This station supplies current for operating the two guard-gates and the five locks of the Waterford series and for lighting this stretch of canal. At the western end there are provided head-gates.

About ten miles above the Crescent dam is the other large fixed dam of the canal, known as Vischer Ferry dam, this name also coming from a near-by hamlet. These two structures are much alike; the general design is the same and the dimensions do not differ widely. The site chosen for this dam was one having two river channels encircling an island of considerable size, which had steep shores and a rocky plateau-like top some twenty feet above the river. A dam was built in each of these channels, and connecting the two sections was a third section across the island, making one continuous crest of nearly two thousand feet. Each section is straight in plan and the trace of the whole structure is roughly that of a reversed letter Z. The crest of this dam is 36 feet above the apron; its bottom width is 40 feet 6½ inches, its top width, 11 feet 5 inches, and the width of its apron, 38 feet. It contains 58,750 cubic yards of concrete. With the immediately adjacent locks, one of Barge canal dimensions and 26 feet lift at one end and a temporary lock of old size at the other, the amount of masonry at this locality reached a total of 90,000 cubic yards. The small lock was needed to maintain navigation during a part of the time while construction



Large fixed dam, known as Crescent dam, at the foot of Mohawk river navigation. View from beside the power-house, showing the whole sweep of 1,922 feet of length, with the head-gates at the extreme left and the intervening island in the middle.





was in progress and before the new channel both below and above the dam was completed. This dam too forms a lake of considerable size.

Descriptions of the Delta and Hinckley dams, the two prominent reservoir dams, are given in connection with the chapter on water-supply and so need not be included here.

We desire to speak of three types of movable dam in use on the Barge canal. The first is the kind known as the bridge dam with Boulé gates. This type, however, was described so fully in our study of early canal policies that little need now be added. There are eight of these bridge dams on the lower Mohawk. These are situated at Scotia, Rotterdam, Cranesville, Amsterdam, Tribes Hill, Yosts, Canajoharie and Fort Plain. Four of them have two spans and four have three spans, the various lengths of span being 150, 180, 210 and 240 feet. The total lengths of these structures range from 370 to 590 feet and the depth of water between sill and upper level varies from 16 to 20 feet. For operating these dams steam winches were tried at first but now electric winches have been supplied. A part of the dam across the Genesee at Rochester is of this type. Bridge dams, but smaller in size, are also located at Mohawk and Mays Point.

The general principles which governed the designing of the bridge dams were these: To reproduce the natural area of discharge at each site, so as to avoid changing flood heights; to use high dams, so as to reduce their number and length and therefore their cost; to use few pieces, so as to concentrate the strength and reduce the number of pieces to be handled; to place a minimum amount of steelwork permanently under water, because of rusting; to make all parts of plain workmanship and similar as far as practicable, and to incorporate only such features as had been successfully adopted elsewhere or concerning the success of which there appeared to be no reasonable doubt.

Another type of movable dam of which there are many examples on the Barge canal is the Taintor gate. This has been used in a wide variety of ways—as a whole dam, as a regulating section in conjunction with a fixed dam, as a gate to fill a notch in a fixed dam, as a by-pass gate beside a lock, as a by-pass gate around a guard-gate, and as a crest across the top of a low fixed dam. An unusually large dam of this type has been built beside lock No. 1 of the Champlain canal, a short distance north of Waterford. It serves here as the regulating section in connection with a fixed dam and consists of six gates, each 50 feet wide in the clear and having

a vertical height of 17 feet above the sill. A single gate of still longer span is that at Whitehall, where it forms the movable crest on a low fixed dam and is operated from a highway bridge which crosses the stream at this point. The clear length of this gate is 90 feet. The four other most conspicuous examples of Taintor gate are those at Cayuga and Waterloo, where the gates constitute the whole of the structures that act as regulating works for Cayuga and Seneca lakes, respectively, and those at Phoenix and Fulton, where they form regulating sections in conjunction with fixed dams and regulate the Oswego river.

The Taintor gate is a sector gate and also it is the usual form of sector gate, but for the Rochester dam a somewhat novel adaptation of this type was devised, for which, however, a name no more distinctive than submersible sector gate has been used. In the sector type of dam, it may be explained to the non-technical reader, the movable portion, when viewed in cross-section, forms the sector of a circle, of which the arc is the upstream face. The movable part is usually constructed of steel, the face being a solid plate. This gate is attached to and moves between abutments, piers or other suitable forms of masonry. In the Rochester dam the sector gate is pivoted at about the level of the stream bed on the downstream side rather than above the water-level of the upstream side, as is the usual Taintor gate. In passing water through the ordinary type the gate is raised and the water flows beneath. At the Rochester dam the gate is lowered into a recess in the masonry and the water flows over it. The dam across the river at Rochester is made up of two types, the longer portion being a bridge dam. The reason for making a part of it of the sector type and of this peculiar kind of sector is the presence in the river of much flood wood. This gate at Rochester always presents an unobstructed crest to the water in whatever position it happens to be, whether fully raised or fully lowered or at any point between. It thus becomes a clear and free but adjustable spillway. So that debris may find no lodgement after it passes the crest, a deck is provided on top of the sector-shaped ribs which support the face of the gate, this deck forming an inclined plane, down which the water may flow, and simply changing its angle of slope with the raising or lowering of the gate.

Aside from the locks and the dams there are only two structures of which we desire now to speak, and one of these is really a type of dam. These are the siphon spillway and the automatic crest for a dam. Both structures are new in the field of engineering and were

developed in Barge canal design. The engineer who conceived them holds patents governing their use, but the State was not required to make any compensation.

The siphon spillway is a structure particularly fitted to localities where there is not room for the usual long overflow spillway but where it is essential nevertheless automatically to regulate the surface-level of a body of water within fixed limits and prevent it from rising much beyond a given elevation.

In many places the Barge canal receives the drainage from the land adjacent to its channel. As a widely fluctuating canal water-surface is to be avoided if possible, it has been necessary to get rid of any surplus, and if this water at times may flow in rapidly it must be discharged with equal rapidity. Where conditions permit, this has been accomplished ordinarily by a waste-weir of sufficient length of spillway to pass the required amount in a given time. But when the volume is large the spillway must be long and sometimes conditions exist which make a long spillway undesirable or even impossible. It was the presence of such conditions, especially at Whitehall, one of the places where a siphon spillway has been built, that led to the designing and introduction of this new structure. It is believed that in this structure the siphon principal was used for the first time to create a spillway of any considerable size. The siphon action is entirely automatic, in both the starting and stopping of the flow. The reduction in length between this structure and an ordinary spillway varies with the available head of water, but the several spillways of this type on the canal accomplish as much as the old kind from three to five times their length. The economy in cost of building the siphon type is also considerable.

As the name indicates, the surplus water is discharged through a siphon, or rather through the several siphons which are incorporated in each of the structures as they have been built on the Barge canal. These siphons are inclosed in a concrete wall, which, except for openings in its faces, differs little in outward appearance from any wall that might be built to separate two streams having different surface-levels. The siphon is simply a cavity in the wall. Its inlet is placed well below the surface of the stream to be regulated; its outlet is as low as the stream that carries away the flow will permit; its crown rises to the elevation at which it is desired that the discharge of water shall begin. On the canal the permissible surface fluctuations are not large, and as the siphon does not come into action until completely filled with water, it has been necessary to

limit the height at the crown to the range of fluctuation at each particular locality, the necessary area being obtained by increasing the width at the crown. The bottom of the crown is at the low-water level and at this elevation vents pierce the wall from outer face to siphon. When the water has been drawn down to this level, air enters through these vents and stops the flow through the siphon. A little below these vents a precautionary vent is placed, to break the flow in case the upper openings become clogged. These are the essential features of the siphon spillway. In designing one, however, there are other details to be worked out, such as the flaring of the inlet to reduce loss of head due to entry, a screen at the inlet to prevent the entrance of floating bodies, the development of the siphon dimensions from a wide and low crown to more nearly square inlet and outlet, forms which may be removed after the concrete is poured and an ordinary spillway to act as a drift gap and carry off debris.

The second of the two structures we mentioned is an automatic crest on a dam. Only one of this type was built on the Barge canal. The masonry portion is much like an ordinary low dam, with abutments rising several feet above the crest. The movable part runs lengthwise along the whole masonry crest and has a close-fitting contact with each abutment. It is made chiefly of wood and consists of two leaves set at right angles and hinged at their intersection to the top of the masonry crest. These leaves are L-shaped in cross-section, the upper leg being slightly longer than the lower. On the downstream side of the masonry crest, directly beneath the hinge, is a recess in the masonry, in cross-section the sector of a circle, into which the major portion of the movable crest may drop, the whole of it swinging down below the level of the masonry crest. The lower leaf is prevented from rising entirely out of the recess, being stopped by a projecting steel plate along its upper edge. Several openings through the masonry connect this recess with the water above the dam. The principle of operation is that of unequal water pressure against the two leaves, the leaves being properly proportioned and carefully weighted in order to make the action automatic. In picturing the crest in action we shall assume that water above the dam is at the level of the masonry crest and is rising. The pressure against the lower leaf has raised the movable crest as high as it can go. As the water rises, the pressure against the upper and longer leaf gradually increases until it becomes equal to that against the lower leaf. A little beyond this point and the crest begins to

swing down, going quickly once the water has begun to flow over. It drops completely below the masonry and allows the flood to pass before the pressure on the lower leaf raises it and brings it again into action.

In the western part of the state the canal in a few places is carried on the tops of rather high embankments. In these localities concrete troughs with bottoms and side walls of masonry have been built. These structures deserve a brief notice. Those constructed at first did not have the drainage features of the later style but otherwise were about the same. The trough was not designed to carry the whole weight of the water as an aqueduct would. Rather the underlying thought was to prevent serious breaks by not allowing leakage to get a start. The plan was very simple — just two courses of concrete in the bottom of the prism with a layer of screened gravel between. In the gravel were laid lines of drain tile every twenty feet and on top of the upper course of concrete tar felt waterproofing was placed. The side walls, well joined to the bottom courses, were about of standard design except that inspection chambers six and a half feet high ran through them lengthwise and at the side of these chambers was a channel into which emptied the lines of drain tile. The side walls were well backed by embankments at least 22 feet wide at the top and sloping down on a one on three slope.

Aside from the individual structures there are also numerous localities on the Barge canal which during construction have presented such complex and difficult problems that a record of the solutions is of considerable interest, especially to the engineer. We cannot now describe all places of this character, the list is too long, but briefly we may mention four — Waterford, Rome, Rochester and Medina.

In all the story of transportation west from the Hudson river there has always been the difficulty of getting out of the river valley and up the first stage of the ascent. The early highways made it by steep climbing or lengthened windings. The waterway which preceded the first State canal, lying mainly in the Mohawk river channel, stopped at Schenectady and depended on wagons to deliver goods from the Hudson. The original Erie canal had locks so close together that too frequent lockages set the boats aground. When the canal was enlarged the peril of grounding was overcome by longer levels, but still the many locks were a grievous trial to navigators and a hindrance to rapid movement. The first railroad mounted the acclivity by pulling its cars by ropes up a sharp incline

before it began the overland journey under power of its locomotives. Later a gradually ascending route was adopted, but the long years of using extra locomotives for pushing trains have borne witness to the difficult situation.

It was this problem of getting out of the Hudson river valley that lay at the bottom of selecting the Waterford route for the Barge canal. After the locks had been relocated and rebuilt during the first canal enlargement no improvement was attempted until the period of the nine-foot deepening, when plans were made for a high pneumatic lock, designed to take the place of the sixteen ordinary locks near Cohoes. But that improvement came to an end with nothing done towards building the lock. In the two surveys which followed almost immediately — the Deep Waterway and the preliminary Barge canal — routes either beside or very close to the Cohoes falls were the only ones considered. It was after engineering forces for constructing the Barge canal were organized and sent into the field for additional data that the route along which the canal has been built was discovered. This route, which makes the passage from the Hudson to the Mohawk through a land line about two and a half miles long is so far from the falls, at least a mile at the nearest point, that it had escaped serious consideration earlier. Its advantages were so marked, however, that it was speedily adopted. It follows a natural valley to within a short distance of its upper end, but thence it passes through deep rock cutting. It enters the Mohawk above both the Cohoes falls and the dam of the Cohoes Company and also above the site of the new Crescent dam, which has created a pool above the land line for ten miles of river navigation.

Because the Waterford land line solved the problem of passing from the Hudson to the Mohawk and because its completed structures contain so much of engineering concern, it becomes a place of importance. On this short stretch a visitor may see more to interest him and a greater variety of structures than on any other portion of many times its length. The locks are not of the tandem variety, as the preliminary plans required, but have short pools between them. There are five of them and they constitute the greatest series of high lift locks in the world. The lifts vary from $32\frac{1}{2}$ to $34\frac{1}{2}$ feet and the aggregate is 169 feet. The distances between the locks are so short that the pools had to be widened, so as to store sufficient water for frequent lockages. There are by-pass channels around all of these locks. An interesting type of concrete docking borders the

channel in several of the pools. There are two guard-gates above the locks — to protect both the canal line and the cities below. Without these guard-gates, were some accident to destroy a lock gate or tear out an embankment, all the stored waters of the Mohawk might come pouring through. Before the unprecedented flood of March, 1913, only one guard-gate stood at the head of this line, but from the experiences of that time the State Engineer, who himself watched through one night while the flow reached its maximum, was led to build a second guard-gate. These gates have Taintor gate by-passes around them. There are other features of note along the Waterford line, such as the great Crescent dam, the power-plant at its end for supplying the whole stretch with electric energy, the transmission line with its concrete poles, the three power substations, the deep rock cut, the high retaining walls and the several bridges, both railroad and highway.

The preliminary Barge canal survey considered two routes at Rome, one through the southern outskirts of the city and the other directly through the city, following the line of the existing canal for much of the way. The northerly route provided for a level higher than the other by several feet. The southerly route was crossed twice by the New York Central railroad necessitating two long four-track bridges. When, prior to construction in this vicinity, it came to making a final decision as to routes, there were three parties to the conference — the State, the city and the railroad company. In most of its course through the Mohawk valley the railroad runs close to the north side. After crossing the old canal at Schenectady, it remained on the north side of the waterway as far west as Rome, where it crossed to the south side. The new canal, however, was to be crossed east of Utica and thence westerly the waterway could remain on the north side except for the possible crossing and recrossing at Rome. The northerly route, therefore, had the advantage of eliminating these two bridges, but it had compensating disadvantages. The canal question, however, was not the only one at stake. There were several railroad features, irrespective of the canal, which entered into the consideration. The railroad had to swerve to the north and back again for the purpose of reaching Rome, rounding a very sharp curve to accomplish it. The station was old and sadly needed rebuilding and moreover it was on the wrong side of the tracks, passengers having to cross freight tracks at grade to reach the coaches. Most of the city crossings were at grade. The problem, thus complexly involved, awaited solution for some time before an agreement satisfactory to all concerned could be reached.

Finally the southerly canal route was chosen, but the railroad line was changed also, being thrown to the south of the canal. This meant a relocation of several miles of road, but the company gained a much better alignment by the change. The canal too was changed from the line first contemplated, being carried straight west to an intersection with the old canal at New London instead of circling to the north and meeting it at Fort Bull. Thus both the canal and the railroad were straightened and shortened and were taken out of the built-up portion of the city. But the work involved in all these changes and new structures was enormous and Rome became a busy center of canal activity as well as a place where much of interest could be seen. So far as costs were concerned there were no large differences between the various solutions of the problem.

If we were to visit the finished canal at Rome, we would find several important structures. At this point the waters from the Adirondack reservoirs are received. These come down through the Black River canal to the Delta reservoir, where a new and large impoundage has been provided for the Barge canal. Thence the augmented supply reaches the Rome level through the Mohawk river. The whole flow of the river is taken into the canal at this point. A retaining dam lies in the bed of the stream just above its entrance into the canal. Water not needed for feeding the land line sections to the east and the west is spilled into the old river channel over two spillways, one near-by and the other at some distance away, towards the easterly end of the level. This water, however, is utilized for canal purposes farther downstream, for the canal occupies the river channel throughout most of its course eastward to the Hudson. There is a guard-gate at each end of the section of canal carrying the whole river flow. When desired, these gates confine the feed water to this section — the common practice in winter and a possible action in all times of emergency. The new canal crosses the old at Rome, but at a lower level. Since it has been necessary to keep open both portions of the old canal, a junction lock has been built on each side of the new channel, allowing old-sized boats to lock up into the old canal in either direction. The section of old Erie canal to the west has become in effect a part of the Black River canal, being needed to furnish a connection between that waterway and the Barge canal. But instead of cutting off the old Erie immediately west of its junction with the Black River canal, it remains open to the western border of the city, where a dam across the old prism stops further navigation. The section of the old Erie to the east is the portion which was retained under the terminal law and origi-

nally extended to Mohawk. A dive culvert, or inverted siphon, to feed this stretch, was built under the new channel at Rome. The detailed account of the Rome-Mohawk section is given elsewhere. Aside from the foregoing structures there have been a few bridges and some new highways and in connection with the railway relocation there was the long new road-bed and a modern station for the city.

The early canal was the chief factor in building up the remarkable chain of cities and villages that spans New York state. Later came the railroads and also many other influences to complete the work, but it was the canal that fixed the locations and gave both the initial impulse and the controlling impetus toward growth. Thus it is that we find the old canal running through the centers of large cities. When it came to enlarging the channel to Barge canal dimensions, however, it was clearly seen that the expense of building the new waterway through these crowded cities was prohibitive. This and other reasons have turned the channel to the outskirts of the municipalities wherever possible. So it was with Rochester. Several routes in this vicinity were studied during the preliminary survey, but the authorizing law laid down the route circling the city on the south about as it has been built except that amendments later put the spur to the city in the Genesee river rather than in the old Genesee Valley canal.

The work at Rochester was the last large portion to be undertaken. This was not because the engineering problems could not be solved nor because choice had to be made between routes, but the citizens were opposing what the State was attempting to do and it was years before agreements could be reached. The delay in coming to terms with the railroads also retarded progress. If construction had been begun earlier in this vicinity, doubtless the whole canal could have been opened earlier, or at least it could have been opened without such almost superhuman efforts as were actually required for the accomplishment. When State Engineer Williams assumed office in 1915 he perceived that the Rochester problem had to be solved speedily or it would block the whole canal scheme. He attacked it with determination and the result was that as soon as money was forthcoming to begin construction again after the exhaustion of funds the work at Rochester started. But we are not concerned now with details of construction or policy and moreover they are discussed fully elsewhere. The large and rather complex work in the vicinity of Rochester has engineering interest and that is the feature which is taking our attention just at present.

The problem at Rochester was this: The canal could not well pass through the city, but there had to be some way for boats to enter as close to the business center as possible. A line somewhere along the southerly city borders appeared to be the most feasible route, and this in conjunction with a spur in the Genesee furnished access to the city. Except for complicated details this part of the problem was simple and had to be solved in accordance with certain specifications in the law. But the route to the south which seemed best, all things considered, involved passage through a city park, deep cutting in both earth and rock, high embankments, and six railroad crossings. Also the spur line in the river was bordered on each bank by a railroad, and moreover the river was subject to unusually high floods. It was the park, the railroads and the flood conditions that presented the more difficult engineering problems, but none of these was really serious, once the way was cleared for action.

By taking scrupulous care the engineers have not allowed the canal to spoil the beauty of the park. Ornamental bridges, both foot and highway, span its waters. Spoil-banks have been graded, fertilized, seeded and sodded. Dikes border the river and drains care for any possible seepage. A guard-lock stands on each side of the Genesee river crossing. The bulk of the work has been along the river, where long, high walls line the banks, and the railroads have been altered to fit changed conditions, a new passenger station having been provided in one instance. A commodious terminal, at the end of the spur, is in the very heart of the city. A convenient approach to the terminal was a work of considerable size and involving some interesting structures. The walls along the river have been built high enough to overtop any known flood, but to make assurance doubly sure provision has been made for placing flashboards upon them in case of need. A movable dam at the lower end of the spur maintains the proper water-level for both the spur and the main canal at the river crossing. This dam is made up of two types, the bridge dam and the submersible sector gate, both of which have already been described. The new dam is situated a little below an old dam, which has been left intact. When the new dam is not in operation, former conditions, except for deepened channel and wall-lined banks, will be exactly restored. During construction, for the purpose of maintaining navigation, a temporary dam in the river and a temporary lock in the old canal west of the city became necessary.



Channel circling the deep gorge at Medina, behind a wall having a maximum height of 45 feet; in effect running behind a high dam for nearly a third of a mile. The outer face of this wall appears in the distance; in part it flares to an overhang, giving a top width of 15 feet for a passageway. To compensate for sharp curvature the channel reaches a maximum width of 300 feet. Frame terminal warehouse at the extreme right.





Because of the difficulties involved in the problem of crossing Oak Orchard creek in the village of Medina, a short stretch of canal in this vicinity became one of the most interesting portions of the whole line and received a greater amount of study than any other section. The old canal passed this locality by following a sharp horseshoe curve. Just below the canal crossing the creek descended a steep declivity and its valley widened into a gorge which, at the point where a direct line would cross it in connecting the straight stretches of canal on either side, was 500 feet across at the top and 90 feet deep.

To have carried the new canal across this gorge would have secured excellent alignment, but the plan involved serious difficulties. All of the early studies, however, contemplated some method of crossing along the straight line. Soon after the Barge canal was authorized, two tentative schemes were considered. One was by means of an earth fill, on which was to be a channel of standard embankment section. This plan gave an extremely wide fill and was not given very serious consideration. The other method was by means of a steel trough supported by steel trestlework resting on concrete piers. Plans along these lines were not worked out so carefully as were those of the later studies. When, after a little while, the consideration of this locality was begun in earnest, complete plans and estimates were made for seven schemes. A comparison of these methods and their relative costs is of interest, especially to the engineer, since it shows the advantages of a concrete over a steel structure and also that both of these are cheaper than an earth fill.

The seven schemes and their costs, which included simply the length of canal across the gorge, were as follows: (1) A steel cantilever structure with a steel trough for the canal, which was estimated to cost \$500,000. (2) A three-hinged steel arch of 300 feet span, center to center, carrying a steel trough for its length of 300 feet, the approaches of about a hundred feet on either side being concrete troughs supported on short concrete arches. The estimated cost was \$405,000. (3) The same steel arch and trough, but with approaches built all of steel, the cost being \$407,000. (4) A concrete arch in place of the steel arch, the remainder of the structure, both trough and approach supports, being of steel, at an estimated cost of \$300,000. (5) An all concrete structure, consisting of a plain concrete trough on a concrete arch of 300 feet span, center to center, which was estimated at \$272,000. (6) The same concrete structure, but with architectural adornment, which would raise the

cost to \$285,000. (7) An earth fill over a long culvert, the canal to be carried in a concrete trough, estimated to cost \$433,000.

After careful consideration the sixth scheme was adopted for making detail plans on which to let a contract. The reasons for the choice were, briefly, that this concrete structure was considered to be the safest, the most permanent, the cheapest to build, the cheapest to maintain and the most pleasing in appearance. Complete contract drawings were made and for some time it seemed that the canal would be built in accordance with these plans. In developing the plans the arch was made a little shorter than in the tentative scheme. The dimensions of the proposed structure, however, are given in the chapter on canal construction and need not be repeated. A full description is given there also of the careful tests made on model arches in order to ascertain beyond doubt, before undertaking construction, that so novel a venture would not fail. It was told too that, although the tests proved the stability of the structure, it was finally decided to build the new canal along the old alignment.

But before this final decision was reached another scheme was considered, that of crossing the gorge on a rock fill. This fill was to be made of quarry spalls, which could be obtained cheaply from near-by. On its top there was to be a cushion of earth and a concrete trough backed by small earth embankments. The estimates showed this project to be about \$90,000 cheaper than the concrete arch, but plans were never worked out in careful detail.

The canal as it finally was built in this vicinity embodies several interesting engineering features, the most important being the long stretches of retaining wall, some of it unusually high, and the aqueduct over the creek. Although the extent of canal under this contract was only two and a third miles long, there was on the north side one continuous stretch of retaining wall nearly seven thousand feet long while on the south side two pieces together measured about forty-six hundred feet. Between fifteen and sixteen hundred feet of the north wall was high, extending in some places well below canal bottom, to the natural surface as it sloped down toward the gorge. Here the bed of the canal is a rock fill and the wall beside the channel sustains hydrostatic pressure for its full height, which reaches a maximum of 45 feet. Thus in effect the canal runs behind a high dam for nearly a third of a mile. As a preventive against leakage at this high wall a vertical plate of steel was embedded six inches in each of two adjoining sections at the joints formed in construction.

The aqueduct, while it is not spectacular like the proposed long structure and has a span of only 50 feet, still is the longest aqueduct on the new canal. The arch ring has a thickness of three feet at the crown and of 6 feet 10½ inches at the springing line. The rise is 12 feet, the radius of the intrados, 32 feet, and that of the extrados, 49 feet. The clear width of channel between side walls is 125 feet. So as not to interrupt navigation the old aqueduct had to be torn out and the new one built in one winter season, and of course concrete had to be kept from freezing until all danger of injury had passed. An outstanding feature of this structure was the care taken to prevent leaks. Steel plates similar to those used in the high retaining walls were embedded at all joints, both those between the several arch rings and those between the rings and the side walls or the skew-backs. Also the top of the arch was covered with a waterproofing of tar felt and pitch which was joined to the side walls in a rather novel fashion, to prevent it from cleaving off. Into rectangular grooves left in the side walls a few inches above the arch the edges of the waterproofing material were tucked and then the grooves were filled flush with concrete.

The descriptions of engineering features connected with the Barge canal could be continued interminably and, perhaps with profit to an interested engineer, but those already cited must suffice for the present volume.

CHAPTER XXIV

THE WATER-SUPPLY

General Scheme of Supply—Discussion of Water-Supply Requirements for a Canal—Supply for Western Portion of Erie Canal—Supply for Rome Summit Level—Old Sources of Supply for Rome Level—A New Source, Delta Reservoir—Its Characteristics and Size—Another New Source, Hinckley Reservoir—Its Characteristics and Size—Still Another Source Considered—Supply for the Champlain Canal—Supply for the Oswego Canal—Supply for the Cayuga and Seneca Canal.

THE PLANNING of an adequate water-supply for a canal as large as the new waterway system in New York state, while not the most difficult task, was one which required thorough and extended study. This task was much simplified, however, by work which had preceded it, for during the many years of the old canals the State had been building up a large system of reservoirs and feeders and with but few exceptions these were retained for the new canals.

Throughout considerable portions of their length the several branches of the Barge canal utilize existing natural streams, making them canalized rivers, and in general the ordinary flow of these streams is sufficient to maintain the requisite depth of water in the levels between the locks and also to supply the water required for lockage and incidental purposes. In other portions of the route the canal follows what are called low-level lines, using the stream valleys although not always lying actually in the stream beds. In this respect the new canal differs from the old, which as a rule was built on a level somewhat above the streams that it paralleled throughout most of its length. The adoption of these low-level and canalized-river lines also greatly simplified the problem of water-supply, but they were not chosen for that reason alone; they have other advantages and these were uppermost in prompting their selection.

Water is required in operating a canal for six main purposes, namely, to fill the canal prism, to fill the lock chambers, to provide power for operating lock machinery, to provide power for lighting the vicinity of the locks, to replenish loss due to unavoidable leakage through gates, culverts and turbines at locks, and to replenish loss in the levels between the locks.

In discussing these purposes it may be said that an independent water-supply for filling the canal prism is needed only in land lines and then only at the opening of navigation or after water has been drawn from the levels for some reason, such as making repairs. In river lines the natural flow of the stream will of course fill the prism.

Next in importance to filling the canal is the use of water for lock operation. A canal is essentially an inland transportation line in which the grades are overcome by water-power. That the energy is applied through the buoying power of the water makes it no less an application of water-power. Considering the mechanism that would be necessary to lift a boat mechanically without a lock, it is probable that by this means there would be attained little if any greater net efficiency than that secured by the usual lock. In addition the lock has the advantage of simplicity, quick operation and avoidance of strain on the boat. There may be a waste, of course, occasioned by the order in which boats pass a lock. If they go up and down alternately, then one lockful of water will suffice for lifting one and lowering the next. If boats run in the same direction in sequence, then a lockful is required for each boat or each fleet of boats going up or down. But even allowing for the waste of energy in lowering boats when a separate filling or emptying of the lock is required, the canal lock is a fairly efficient water-driven machine.

The amount of water required for a lock varies not only with the height of the lift but also with the amount of traffic. And for a given amount of traffic the water-supply varies according to the size of boats, since large and small boats use an equal amount of water for lockage, and also according to the manner in which they pass the locks, whether singly or in groups and whether lockages in the same direction are made in sequence or alternate with lockages in the opposite direction.

Of the third and fourth purposes of the water-supply, those of providing power to operate and also to light the locks, little need be said in amplification. The old locks were generally hand-operated, but for a large, modern canal such method can be considered only in the exigency of disabled electrically-driven machinery. In studying the Barge canal problem it was found best to provide a separate source of power at each of the locks, except in the few cases where locks are so near together as to be easily supplied from one power-plant without long transmission lines.

The loss of water in the levels between locks occurs chiefly in the land lines and includes seepage through embankments, waste

over spillways, evaporation from water-surfaces and transpiration through aquatic plants. In the river lines there is no loss over spillways and little from seepage.

The critical points in supplying water to canals are usually the summit levels. Although lower levels may demand more water, it is usually more readily obtainable. Proceeding downward from a summit the supply required at any lock may be taken — to use mathematical terms — as the sum of the losses between the source of supply and the lock, plus the water needed at the lock, minus the natural inflow between source and lock. Thus it appears that the necessary supply may vary greatly from point to point. In providing water for a summit level it is necessary, therefore, to obtain a supply adequate for the points of greatest demand on both sides of the summit. Generally speaking the lock of highest lift is the point of greatest demand. Whether the lock of highest lift is near to or remote from the source of supply, and the volume of intermediate losses or acquisitions, govern the amount that must be supplied at the summit.

From this description it is seen that the problem of estimating the water-supply for the Barge canal was rather complicated and embodied several indeterminate factors. It was necessary, therefore, to allow a liberal excess, or reserve, as a factor of safety.

On the new Erie canal the descent is downward from Lake Erie to the confluence of Seneca river, which flows from the west, and Oneida river, which comes from the east, where they join to form Oswego river and run north into Lake Ontario. From this junction of Seneca and Oneida rivers, called Three River Point, there is a rise to a summit level that stretches between New London and Whitesboro and is known as the Rome summit level. Thence easterly there is a descent to the Hudson river. It is seen, then, that there is one true summit level, that at Rome, and one half summit, that extending easterly from Lake Erie.

The largest independent supply required for any portion of the Barge canal is that needed at the western end. Fortunately an almost unlimited supply is available by tapping Niagara river at Tonawanda. The lock of highest lift that is fed from this source is located near Pittsford, a little east of Rochester. It is necessary, therefore, to draw enough water from the Niagara river to operate this lock after allowing for the loss and waste in nearly one hundred miles of canal. Sufficient water from the Niagara to furnish an adequate supply at the Pittsford lock, however, is enough for the tandem locks at Lockport, which have a combined lift of forty-nine feet.

In order to carry the water in requisite volume easterly from Niagara river it is necessary to give the canal bottom the proper slope in the levels between Tonawanda and Lockport and between Lockport and Rochester. In doing this provision has been made for carrying at least 1,237 cubic feet of water per second. It has been proved in both theory and practice that a moderate current in the direction of greatest traffic in a canal is advantageous. The eastward current resulting from the flow of Niagara river feed-water through the western portion of the canal is about two-thirds of a mile an hour. As the greatest traffic on the Barge canal is east-bound, the current at the western end is beneficial as well as unavoidable. With the ample water-supply from the Niagara river it is unnecessary to draw any water from former feeders in this territory, such as the Oak Orchard creek at Medina and the Genesee river at Rochester.

Although the amount of water required for the Rome summit level is less than that for the western section, the difficulties of securing an adequate supply are greater than for any other portion of the Barge canal. Throughout the existence of the State canals this part of the system has always presented the most difficult problem in water-supply and this has led to the building of numerous reservoirs among the hills to the south of the canal and also within the Adirondack region on the north. A potent factor in determining the question in 1836 of building the Black River canal was its ability to bring the waters of the northern forests to the needy Erie, the very name given by law — The Black River Canal and Erie Canal Feeder — indicating one of its chief functions. As we have said elsewhere, doubtless this canal would have been abandoned along with the other laterals but for its necessity as a water-supply feeder. Because of this difficulty in supplying water there have been attempts in later years to eliminate the Rome summit level and these have caused investigations to be made for a line of continuous descent from Lake Erie to the Hudson, but all construction along such a line has seemed too costly to be practicable.

The Rome summit level of the new canal extends from lock No. 20, near Whitesboro, to lock No. 21, which lies between the hamlet of New London and Oneida lake. The Rome summit level of the old canal reached from Utica to Syracuse and was about fifty-six miles long. Its elevation was nearly ten feet higher than that of the new level. The use of the shorter summit at a lower elevation reduces the difficulties attendant upon securing an adequate water-supply.

It happens that a lock of 21 feet lift is situated near the easterly end of the new Rome summit level. Water sufficient for operating this lock, together with the natural supply drawn from the Mohawk river and its tributaries, is adequate to operate the canal throughout its length easterly to the Hudson river. At the westerly end of the summit the canal descends through two locks, each of 25 feet lift, down to the level of Oneida lake, so that a supply sufficient for the terminal lock is all that has to be provided in that direction.

The sources of supply for the new Rome level include substantially all of those used for the old level and two new sources in addition. The old supply north of the canal came from the headwaters of the Black river above Forestport. The waters reached the Erie canal through a feeder to Boonville and the Black River canal thence to Rome. Whatever water was spilled in this passage was caught in the Mohawk river and delivered to the Erie through a short feeder, also at Rome. For supplying the new canal there have been retained the Black River canal, the Boonville feeder and the system of reservoirs above Forestport. The Mohawk river feeder at Rome is no longer needed, since the whole river is taken into the canal and carried for several miles.

The old sources south of the canal are also retained. These consist in part of streams which the old canal crossed — Oriskany, Oneida, Cowassalon, Chittenango, Limestone and Butternut creeks. To secure this supply, diverting dams and feeders had been constructed and on the headwaters of some of the streams reservoirs had been built. After the Chenango canal was abandoned some of its water-supply, which came from reservoirs on the headwaters of the Chenango river, a part of the Susquehanna drainage basin, had been retained, reaching the Erie canal feeders through diverting channels. This source is among those retained for the Barge canal. To bring water from these sources on the south to the new canal it has been necessary to retain as a navigable feeder that portion of the old canal which lies between New London and the Orville, or Butternut creek feeder, which is situated only a few miles east of Syracuse. A new junction lock at New London connects the two waterways.

The new sources of supply, developed in connection with the Barge canal construction, are the headwaters of the Mohawk river and the West Canada creek. The Mohawk, to be sure, under the old arrangement could be diverted to the canal through the feeder at Rome, but as there were no storage facilities, only so much was available as the natural flow of the stream happened to furnish at

any particular time. The building of reservoirs on these headwaters has added two new lakes to the map of the state. Large artificial lakes, built for the supply of navigable canals, are relatively few in number and, if we ignore works like the Indian River lake, partially natural bodies of water, we are not aware of any in existence comparable in size with those constructed at Delta and Hinckley for the use of the Barge canal. But notwithstanding this fact the basin at Delta holds less than one-twentieth part of the capacity of Salt river reservoir, in Arizona, and covers little more than one-third the area of the Ashokan reservoir of the New York city water works. The Ashokan reservoir, by the way, wiped out seven villages, while Delta reservoir covers the site of only one.

The waters of the upper Mohawk are held in storage at Delta reservoir, or Delta lake, as the people of the vicinity prefer to call it. This is situated about five miles north of Rome and occupies a basin formed by an enlargement of the river valley just above a rock-walled gorge, the base of which is about six hundred feet wide at the site chosen for the dam, while its eastern wall, against which the river formerly flowed, rises precipitately and attains in places a height of one hundred feet. This bluff was known locally as the "Palisades." The hills surrounding the basin are arranged on the general scheme of a triangle with one vertex pointing upstream and this suggested to the first settlers the triangular Greek letter delta, the name they chose for the village the reservoir has now submerged. The waters of the new reservoir bring out even more conspicuously than did the hills this peculiar shape of the valley.

It is of interest to notice that in building the Delta reservoir the engineers were merely restoring an ancient glacial lake. In this respect it is like many of the natural basins which have been reoccupied by reservoirs in modern times. Before the reservoir was filled some of the shore lines of the ancient lake were very easily discernible. Excavations for the dam disclosed a buried gorge, pot holes and other evidences of the erosion of the glacial period.

The dam which holds back the waters in this reservoir is about 1,100 feet long, with a spillway 300 feet long near its center, and has a masonry content of about 90,000 cubic yards. Its height is a hundred feet from crest to lowest foundation. The concrete apron is ten feet below the river bottom, so that a permanent pool of that depth is maintained to act as a water-cushion to break the erosive force of the water in its fall of about seventy feet to the surface of the pool. The reservoir has an area at crest level of $4\frac{1}{3}$ square

miles, a maximum depth of 70 feet, an average depth of 23 feet and a capacity of 2,750,000,000 cubic feet. The area of the tributary watershed is 137 square miles. The reservoir submerged ten miles of highways, seven canal locks and one aqueduct and required the removal of 295 buildings. The relocation of nearly two miles of the Black River canal, including four new locks and an aqueduct, was necessary. Incidentally the reservoir has considerable influence in mitigating disastrous flood conditions in the lower Mohawk valley.

The second of these two new sources of supply is West Canada creek. This stream reaches the Mohawk valley in the vicinity of Herkimer, too far below the Rome summit level to be of any material use. To make it available where needed, therefore, a diverting channel about 5.7 miles long takes the water after it has come from the impounding reservoir some five miles by way of the creek and turns it across a rather low divide into the channel of Nine-Mile creek, whence it flows by natural stream to the Barge canal, reaching it near Oriskany.

The reservoir, which is known by the name of the village near which it is situated, Hinckley, is about twenty miles north of Utica and lies in the foot-hills of the Adirondack mountains. The topography of its watershed of 372 square miles is rugged and varies in altitude from about 1,165 to 3,100 feet above sea-level. The drainage basin of this creek, like that of the upper Mohawk, is located in the region which has the maximum precipitation of the state, a precipitation which is exceptionally high during the winter months, in the form of snow.

No constricted gorge, where a short dam might be built, was available on the site of this reservoir. The dam has a total length of 3,700 feet, of which there is a 400-foot masonry section, embodying gate chambers and spillway. The major, or earthen, portion of the dam has a concrete core wall running through most of its length. The masonry content of the dam is 110,020 cubic yards, while there are 611,200 cubic yards of embankment in the earthen section. The masonry has a maximum height of 82 feet above rock and the overfall at the spillway is 61 feet. The maximum height of the earthen dam is 56 feet above the natural surface.

The reservoir forks into two parts, which have a combined length of about thirteen miles but no great width, only about a half mile. Its area is 4.46 square miles and its capacity 3,445,000,000 cubic feet. The maximum depth at crest level is 75 feet and the average depth, 28 feet. It necessitated the removal of 209 buildings, which made



Dam at Hinckley reservoir—on the headwaters of West Canada creek. The impounded waters reach the Rome summit level of the canal after a passage of nearly 20 miles and a transfer from the West Canada to the Nine-Mile creek watershed through an artificial diversion channel. The long portion in the view is the earthen section; nearer are the masonry spillway and gate chamber. At the near end appears a runway for logs.

up parts of three villages, and it submerged seven miles of highways. This reservoir too is of much value for flood regulation, the maximum rate of flood discharge being very materially reduced.

During the early stages of study for the Barge canal water-supply a third new source was considered and careful surveys were made. The site of the proposed reservoir was at High Bridge, Onondaga county, on Limestone creek. But as the studies progressed it became apparent that the canal would not need an added supply from this source and so the plan was dropped, to be taken up again if necessity requires.

The water-supply for the other enlarged canals, the Champlain, the Oswego and the Cayuga and Seneca, presented problems of little moment. The Champlain canal has a summit level on the divide between the Lake Champlain and Hudson river basins. The corresponding summit of the old canal has been supplied by a feeder twelve miles long, which takes its water from the upper Hudson. This same feeder, the Glens Falls feeder it is called, after some improvements, supplies the needs of the northern portion of the new Champlain canal, while the southern portion lies in the channel of the Hudson river.

The Oswego canal begins at Three River Point. Here Oneida and Seneca rivers unite, bringing their natural flow and also part of the supplies from the Rome level reservoirs and Lake Erie. As the canal is chiefly in the Oswego river, its needs are much more than met by the natural stream flow and the added Erie supplies which reach Three River Point.

Seneca and Cayuga lakes, lying at the heads of their respective stretches of the Cayuga and Seneca canal, are natural reservoirs which not only supply all the water this canal needs but also augment the supply of the Erie branch between its junction with the Cayuga and Seneca canal and Three River Point.

CHAPTER XXV

THE ELECTRICAL EQUIPMENT

Radical Change from Former Methods—General Barge Canal Plan—Large Power-Plant at Crescent Dam—Plants at Locks: Vertical Shaft Type: Horizontal Shaft Type: Gasoline-Electric Type: Details of Lock Equipment—Freight-Handling Equipment at Terminals—Grain Elevator Machinery Electrically-Driven.

WHEN in the progress of Barge canal construction it came to providing means for operating the several structures that require operation, mechanism propelled by other than hand-power was supplied, and this type of mechanism was employed as a matter of course. Moreover, equally as a matter of course, electric energy was chosen as the proper driving force both for these appliances and for the later freight-handling machinery. And this was all done with scarcely a thought of the mighty strides that were being made in changing from the canal which even then was but just going out of existence. But when we stop and recall the crude hand-operated structures and the various other devices of the superseded canal, we realize what a tremendous difference electricity has made in the new waterway. Our present canal depends on electricity for its efficiency almost as much as on the enlarged channel.

At each of the locks on a canal there exists a head of water and this circumstance makes it possible to install hydraulic power-plants at virtually all canal locks. Often it is necessary to pass water around a lock to supply the needs of the lower levels and in such instance power goes to waste unless there is present a plant to develop it. Also the cost of installing a plant at a lock is confined chiefly to the machinery, since conduits and wheel-pits may be formed simply by leaving cavities in the lock walls. Moreover the locks of today are too large to be operated by hand and thus it is that we find power-plants on all modern canals.

In general each Barge canal lock has its power-plant. There are 31 direct current hydro-electric stations and 11 direct current gasoline-electric stations, the latter being such as they are for reasons which will appear later. There is one alternating current hydro-electric station, and this serves five locks and two guard-gates. At a few locks power is purchased from a local power company.

The one alternating current station is situated at Crescent dam and furnishes power for the five locks and the two guard-gates on the land line between the Hudson and Mohawk rivers. This station contains three 75-kv.-a., 2,300-volt, 3-phase, 40-cycle, vertical generators directly connected to Francis inward-flow turbines. From the station a 2,300-volt alternating current is transmitted by an overhead line to three substations, one each at two of the locks and one at one of the guard-gates. At the lock substations the current is converted to direct current at 250 volts by means of motor-generator sets and is then distributed to the near-by locks. The substation at the guard-gate is supplied with transformers, control panels and controllers for two 25-hp. alternating current motors located on the guard-gate superstructures. The poles for the transmission line are made of reinforced concrete.

The 31 direct current hydro-electric stations are of two types, 26 of them having vertical shaft generators and 5 having horizontal shaft generators.

The equipment at one of the vertical shaft type consists of two head-gates, two Francis inward-flow turbines, each directly connected to a 50-kw., 250-volt, direct current generator, a switchboard consisting of two generator panels and one feeder panel, two motor-driven governor oil pumps, two oil pressure governors, a motor-driven oil pump and lubricating system, a traveling crane, four 4,000-watt electric heaters and an incandescent lighting system. At certain locks slight variations occur. If a station feeds two locks, the capacity of the generator is increased to 75 kilowatts and an extra feeder panel is added. If the second lock is less than a mile and more than half a mile distant, a booster set is provided, together with the necessary switchboard panel.

Where the head of water is so low that the turbine speed falls below 150 revolutions per minute, horizontal shaft generators running at a full load speed of 300 r.p.m. are connected to the turbines through bevel gearing.

At the locks beside which are movable dams the power-stations are of the gasoline-electric type. The movable dams are generally raised at the close of the navigation season, thus destroying the head of water and precluding its use when needed for lowering the gates. At each of these locks, therefore, there has been built a station having two 25-kw. gasoline-electric generator sets, with a closed cooling system and incidental electrical apparatus. Eight of these stations are at Mohawk river locks, where during floods the lock walls are

sometimes several feet under water. The power-stations, accordingly, are set well back from the river, on higher ground. In like manner the electrical equipment at these locks is housed in a concrete cabin nine feet high, built on the wall, where it is out of danger from flood. Vertical shafts with the necessary bevel gearing transmit the power from the motors in the cabin to the machinery located in the recesses in the lock below.

The parts to be operated at a lock are the gates, the valves and the capstans. Near each gate is located a master switch stand. A simple movement of the hand will set in motion the machinery for opening or closing the gates or the valves at the end of the lock near which the particular stand is located and this can be done from the stand on either side of the lock. On each stand are five switches, one for each of the two gates, one for each of the two valves and one for the buffer-beam. Once started the action of the motor in accelerating, running, retarding and stopping is automatic. Control panels are located adjacent to the motors they control and are protected, together with the motor, the limit switch and the resistance units, by large steel cabinets. These cabinets can be rolled away from the equipment they protect, thus giving easy access to any part of the apparatus.

Signal lamps are displayed on the tops of the cabinets. On the gate controller cabinet a red light shows for all positions of the gate except when it is fully open. When fully open a green signal appears, indicating that a boat may enter the lock. The signal lamps for the valves are one blue and three white lights, the blue showing that the valve is closed, and one white light appearing when it is one-third open, two when it is two-thirds open and the third when it is fully open.

A 7-hp. motor operates each gate. Through a train of gears this drives a vertical pinion, which meshes with teeth cut in the face of a spar attached at the outer end to the gate. Most of the gate machinery is in a recess below the top of the lock wall and is covered by checkered steel plates. The remainder, together with the electric equipment, is above the lock wall, protected by the controller cabinet.

On a lock having feed culverts of the 5 by 7-ft. or the 6 by 8-ft. size, a 3-hp. motor operates each valve. On the larger locks, those having 7 by 9-ft. culverts, 7-hp. motors are used. A part of the valve machinery is also located in a recess in the lock wall and covered with a checkered plate, while the rest is in the cabinet on the back of the wall.

At each end of each lock is placed an electric capstan, which has a capacity of 8,000 pounds at a speed of 60 feet per minute. The diameter of the spool is 12 inches. Except for the spool and the remote controller the entire capstan is set in a recess in the lock wall and is covered with checkered plates. The master switch is operated by a treadle placed flush with the plates and conveniently situated for the operator while overhauling a rope. The machinery and the 20-hp., compound-wound motor for the capstan are enclosed in a water-tight, oil-tight case. This equipment is designed to escape damage even though submerged.

Electric energy drives most of the machinery that is used at the canal terminals for handling freight, each of the larger terminals having a complete lighting and power-distributing system and also in many cases a battery-charging equipment. In general the freight-handling machinery consists of traveling cranes, derricks, conveyors, tiering machines, capstans, storage battery tractors, trailers and hand trucks.

In the chapter on canal and terminal construction we quoted from a paper read by State Engineer Williams before the State Waterways Association in 1920 on the subject of terminal development. In that paper were embodied brief descriptions of various types of terminal machinery. What we might say now concerning the electrical equipment of the terminals would be largely a repetition of those descriptions and therefore we need not say it. We may simply summarize by adding that it is electric power which is used on three of the four types of traveling cranes, the machines of chief importance at the large terminals. The fourth type is steam-driven because electric energy is not easily obtainable at all places and there must be a machine for such localities. The derricks are simpler devices, suitable for the smaller terminals, but where practicable electric power operates even these. The conveyor and tiering machine are electrically-driven. The capstans, also electrically-driven, do good work in moving boats to convenient places for loading and unloading, and the small but useful electric tractors occupy an important field.

Electricity plays an important part at the Gowanus bay grain elevator. The success of a modern elevator depends largely on the efficient loading, unloading, conveying and other handling of the grain. In such operations electric machinery is used in the Barge canal elevator wherever it is suitable.

CHAPTER XXVI

SOME NOTEWORTHY CONTRACTOR'S APPLIANCES

Comparisons with Old Machinery and Methods—Bridge Type of Conveyor—Tipple Incline—Hydraulic Disposal Boat—Tower Scraper—Aerial Conveyor—Double-Boom Conveyor—Cantilever Crane—Ladder-Dredges and Belt Conveyors—Hydraulic Dredges—Rock-Breaker—Belt Conveyor for Mixed Concrete—Floating Concrete-Mixer—Cableway Concrete-Conveyor—Tower Concrete-Distributor—Bank-Sloper—Instance of Wide Variety of Machines.

IN MANY material ways the world's greatest progress has been made in recent years. This is especially true of the mechanical arts. The huge and powerful machines which today are building our public works are so familiar that we have ceased even to notice them, but we do not have to go back very far in time to find the work they are now doing being done by armies of navvies. The original channel of our own Erie canal was dug with pick and shovel, plow and scraper, and indeed the plow and scraper were considered marked improvements over the more common tools. In the report of the Canal Commissioners to the Assembly in 1818 we read, "It has been ascertained that much labor in excavation is saved, especially in dry ground, by the use of the plow and scraper;" this in comparison with "the European method with the spade and wheelbarrow."

The Commissioners continue, "And even with the spade and wheelbarrow, more progress can be made in excavation, than was supposed. As an exemplification of this remark, the commissioners state with the fullest confidence, on the authority of Messrs. Pease, Mosely and Dexter, that three Irishmen in their employ, finished, including banks and towing-path, three rods of canal, in four feet cutting, in the space of five and a half days. Thus sixteen and a half days' work accomplished the excavation of two hundred forty-nine and one-third cubic yards."

But we do not have to go back to the first building of the Erie canal to find even more primitive methods. A half century ago the Suez canal was completed. During its construction Count de Lesseps' ally, the Viceroy of Egypt, drove the wretched fellaheen by tens of thousands, under the broiling sun, to scoop the sands of the desert

with their naked hands into shallow baskets, to be carried upon their heads, under the lash of the overseer, to the spoil-bank. At night the tired bodies of these workers rested on the adjacent bank without protection. The cruelty and the consequent high mortality of these methods, however, at length attracted attention and drove Europe to rise in protest, and more modern means completed the canal.

In the present chapter we desire to notice briefly some of the machinery used in constructing the Barge canal. It is no more remarkable, of course, than that used on other large modern undertakings, but in comparison with the methods employed on earlier canals, as we have just seen, it becomes interesting. Moreover, like all enterprises of size, the Barge canal has developed some distinctive machines. Its prototype, the original New York canal, was the first large public enterprise in America. When this early waterway was begun there were virtually no engineers and no contractors in the country and machinery for such works was still to be devised. As showing the long road we have traveled between the two canals it is instructive, before we consider the modern machines, to see what beginning the early canal-builders made toward modern methods. To quote the *History of the Canal System of the State of New York*:

"In prosecuting their work through the forests the contractors were in need of an easy means of grubbing and clearing and their ingenuity was equal to the demand. Their inventions, though somewhat primitive, were a long step forward and are interesting as the precursors of modern contractors' machinery. Three of them are deserving of notice. By means of a cable attached to the top of a tree and wound on a wheel worked by an endless screw, one man was able to fell the largest trees. A machine for pulling stumps was made of an axle, twenty inches in diameter and thirty feet long, supported on wheels sixteen feet in diameter; midway on the axle was fastened a third wheel of fourteen feet diameter. When the outer wheels were braced, a chain wound about the axle and fastened to the stump, and horses or oxen attached to a rope which encircled the central wheel several times, a stump was easily pulled and then carried away by the same machine, after the outer wheels had been released. The gain in power was such that, with one machine, a team of horses and seven laborers, from thirty to forty large stumps were grubbed in a day. A plow with an additional cutting blade was invented for use among small roots."

The Barge canal has been built almost entirely by contract. Although the contracts were usually awarded to firms already having

large plants, the nature and magnitude of the canal work seemed to call in many instances for specially designed machines. Moreover, because of inaccessible locations much of the equipment had to be erected at the sites of the operations. The aggregate cost of all the machinery purchased and built for constructing the Barge canal is exceedingly large, running into the millions and probably into the tens of millions.

The largest single machine on the canal was a conveyor of bridge type, used in excavating the deep rock cut near Rochester. This was an adaptation of machines used for handling coal and ore but probably this was the first instance of its use for conveying excavated material. The depth of cut and the elevation of the spoil piles at this locality required a machine which would lift its load of broken rock from 70 to 80 feet, free and clear of all intervening machinery or obstructions, and swing it rapidly well beyond either bank. It had to be sufficiently mobile also to enable it to travel along the line of the canal. The machine built to meet this situation was of huge dimensions. The ordinary heavy, steel-truss, double-track, railway bridge of 100 feet span passed underneath its bulk without obstruction and was dwarfed by the comparison. A man standing beside even the bucket of this machine looked like a mere pigmy. The machine consisted of a bridge of cantilever type supported on two steel towers, one on each bank. Suspended from a trolley car running on the lower bridge chords were an operator's cabin and an immense grab bucket. The bridge measured 428 feet from end to end, the cantilever overhang being 128 feet beyond one tower and 96 feet beyond the other. The towers stood 90 feet high and ran upon parallel tracks. The structure weighed approximately 660 tons. The jaws of the bucket, 10 feet in width, stood 20 feet apart when fully open; its weight, empty, 21 tons; the full capacity of its bite, 12 cubic yards. For a time a large steam-shovel worked in conjunction with the bridge conveyor, loading two 12-yard skips, but it was found that by blasting the rock to smaller fragments the grab bucket could work to as good advantage. The operations of the trolley and the bucket were under the control of a single man. From his window in the trolley-cab, a hundred feet perhaps above the blasted rock, he would let the bucket swoop down like a monster bird of prey, bring it to a stop just above the surface and then let it settle gently upon the desired spot. Slowly but irresistibly the jaws would close, crunching through the rock and engorging a huge mouthful, and then the tons of broken fragments would be quickly

swung aloft and out through the tower portals to the end of the bridge, where they would be dropped on the growing rock piles. Before the last of the rock had reached the pile the bucket would be on its way back for another load, making the complete cycle of operations in from a minute and a half to two minutes.

On the upper portion of this rock cut near Rochester a simpler type of machine was used. This was known as a tippie incline. It was not used for excavating but simply for conveying the rock to the spoil piles. A steam-shovel filled the two cars that ran alternately up inclined tracks and were dumped by being tipped forward over the apex of the incline. A movable extension at the foot of the incline permitted the cars to go down into the cut within reach of the steam-shovel. The whole machine could be moved on tracks parallel with the line of the canal. This type of conveyor was not very common on the canal but several of them were in use.

The material in the bed of a certain portion of the Mohawk river gave rise to a somewhat unique contrivance. Although most of the several parts of this device had been used in other machines, the combination was peculiar and it was the first of its kind. On its side it bore the name, "Dredge No. 3, Canajoharie," but really it was no dredge at all. It became known quite generally as the hydraulic disposal boat, but this name is too indefinite to carry any idea of its nature. The conditions of its building were these: The contract was one for excavating from the bed of the Mohawk river material which, except for the presence of a rather large percentage of sizable stones and boulders, might have been handled by a hydraulic dredge. According to the specifications the contractor, if he did not remove boulders to the spoil-banks, might bury them in the bed of the river, but their tops must be at least two feet under the finished bottom plane and no compensation except for excavation to grade would be allowed. There was not sufficient space in the river to allow of dumping by scow. The only remaining course, the contractors concluded, was to segregate the boulders and send the rest of the material ashore by the hydraulic method. This plan had the advantage of permitting these large stones to be placed along the banks where the handling would be easy and also where they would serve the useful purpose of preventing scour. The disposal boat was the instrument for accomplishing the several parts of this process. In brief it screened out the boulders and placed them in scows for towing ashore, but the bulk of its work was to pump the gravel, the sand and the smaller stones through pipes to the spoil-

areas behind dikes built to hold the solid materials while allowing the water to drain back into the river.

In its entirety this excavating unit consisted of the disposal boat, two dipper-dredges, an attendant tug, scows for carrying the boulders, a small dredge with orange-peel bucket for unloading the scows, and apparatus for building the dikes. The disposal boat was the only part not of standard design.

The hull of the disposal boat was 110 feet long, 38 feet wide and 7 feet deep. The dipper-dredges operated one on each side, depositing their spoil in a hopper at the forward end of the boat. The hopper consisted of two parts, each receiving the output of a single dredge. Each part was a steel-lined table with raised sides and sloping toward a central chute. A constantly shaking motion, towards and away from the chute, was imparted to the tables, and this motion, together with four jets of water at the top of each table, gradually forced the material into the chute, the object being to retard its advance just enough to distribute the load more evenly on the pump that finally put the gravel and smaller stones ashore. The chute was also steel-lined. Here a downward slope and another jet of water moved the material into a revolving screen. This screen was 22 feet $8\frac{3}{4}$ inches long and 6 feet in diameter, mounted on four friction rollers, two of which were used to drive it. It was made of the best manganese-steel castings, built up of three sections longitudinally, each having five parts to form the circumference. The castings were about an inch and a quarter thick, reinforced by ribs and bolted together. The perforations were $7\frac{1}{2}$ inches square, with rounded corners. Between the longitudinal sections, baffle rings, three or four inches wide, projected inward. Beneath the screen was a sump, into which the material passing through the openings fell, aided by a final jet of water introduced at the upper end of the screen. This sump was directly open to the outside water, so that the pump might never suck air, even if its supply of dredged material were too long delayed. The pump itself was set at the extreme stern, connection being made with the sump through a 20-inch suction pipe. The material rejected by the screen rolled down into a skip, which was suspended from an overhead truck that ran on a track extending beyond the sides of the boat the width of the rock scows. One end of this skip could be elevated to dump its load. The skip discharged into scows on either side, according to convenience, the dipper booms of the dredges being long enough to reach the hopper with a scow between the boats. The overhang of the track could be drawn up to a vertical position when not in use.

The pump had a discharge pipe of the same size as the suction pipe — 20 inches. The pumping plant was calculated to discharge its material 28 feet above the water-level at a point 1,600 feet distant, provided no angle in the pipe exceeded 20 degrees. If no more than five feet in elevation were required, the length of the pipe could be increased to 2,400 feet.

The crew for this disposal boat consisted of an engineer and an oiler in the pump room, a fireman and a coal-passer in the boiler room, an engineer to run the 12-inch pump, an engineer in the pilot house, another engineer and one or two boys to operate the skip, and two or three deck-hands.

There was one type of combined excavator and conveyor which distinctly owed its origin to Barge canal work, having been conceived by one of the contractors' superintendents. To this was given the name, tower scraper. It was a device consisting of a simple frame tower and a hoisting engine mounted upon the same base, which operated a scraper bucket, the carrying cable running to a fastening that slid on a cable anchored at the farther side of the cut. By making the tower tall enough its range of operations could be increased to several hundred feet. At first this machine was used chiefly in diking, but later its field was extended to general excavating in shallow cuts and it was installed on many contracts. A variation on one contract was the use of two towers with cables between, standing on opposite sides of the canal cut and each operating its own bucket.

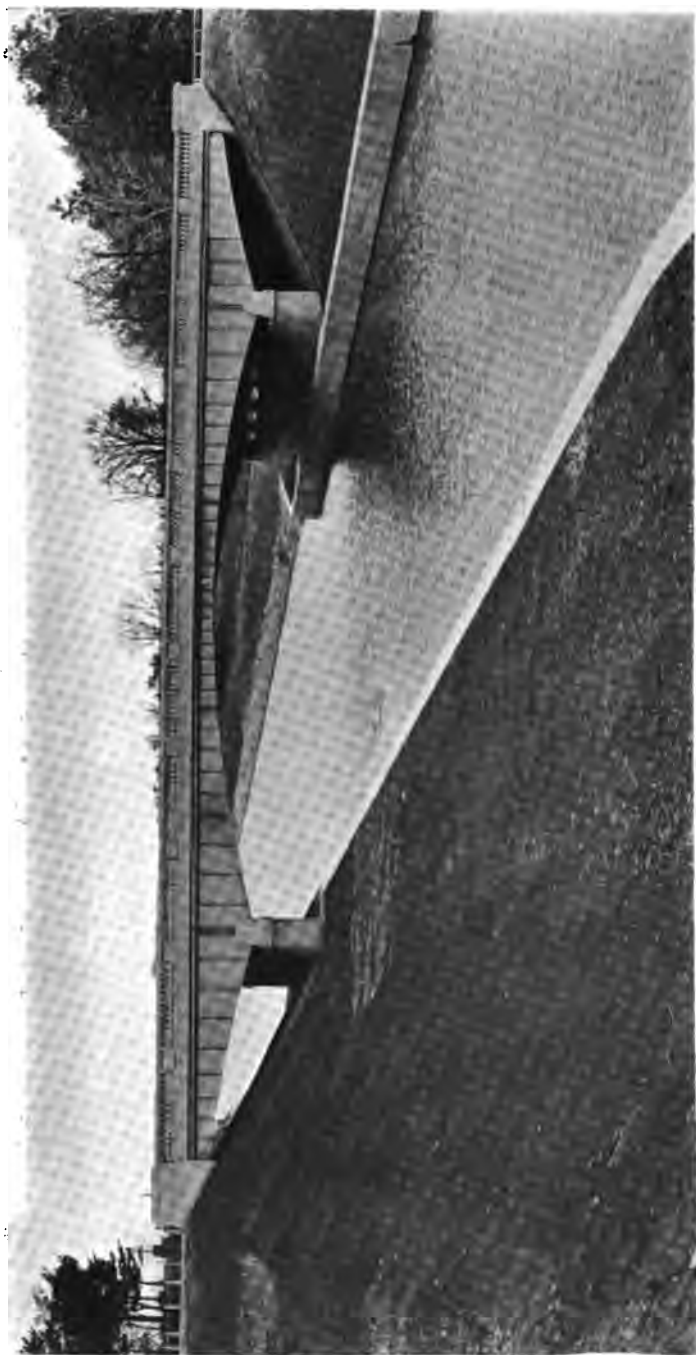
A somewhat similar device, but in this instance an adaptation of a conveyor found in a Vermont quarry, was used on one of the Champlain canal contracts. This was a conveyor simply, operating skips, the excavation being accomplished by other means. It was used in a rock cut and the blasted rock was loaded into the skips largely by hand. For the want of a better name it was called an aerial conveyor. It consisted of a high mast, set at the far edge of the spoil-area, with a series of cables running from the top of the mast to the several near-by places where the rock was being excavated. A small and rather ingeniously equipped car ran on each cable and these cars raised, lowered, carried along the cables and tripped the skips. This rather simple and inexpensive device served the need of its particular locality, where the rock cut was of small extent.

Where long stretches of canal were to be chiseled out of the rock, conveyors of a sturdier type were generally employed. An unusual member of this class was the double-boom conveyor on the section

just west of Lockport, where, perched high on the bank with its two long arms upstretched, it became a memorable sight. It was patterned after one of the most common machines on the canal, the excavator which revolved on a circular track and had a long boom that carried a bucket, generally of the drag-line, scraper type. This latter machine could scoop up a bucketful of earth and then swing around and deposit it at a considerable distance back of the prospective bank line. The double-boom conveyor was an adaptation of this scheme, but its peculiarity lay in two features. It was a conveyor solely, its booms carrying only skips, and it had two booms instead of one. It was fed by a steam-shovel, which followed in the wake of batteries of channelers and drills. The two booms were set opposite and while one skip was being loaded the other was being dumped. The contractor estimated that the time saved by having a skip in position for loading almost continuously, without stopping to attach and detach or to dump it, was of sufficient value to pay for the extra cost of a machine of this character.

Not far from the double-boom conveyor there was another interesting machine, which, however, was operating in earth and was both an excavator and a conveyor. This was a cantilever crane and it resembled somewhat the bridge conveyor, although it was of much lighter and less expensive construction. It was supported by a single, central, steel tower, which traveled on the berme bank of the canal. The excavating arm stretched across the canal to the tow-path, while the dumping arm reached back of the berme for a considerable distance, so that the spoil could be deposited well back of the bank. Operations were controlled from a stationary house at the tower, and the car, which ran on the lower chord, carried a scraper bucket. The superstructure was inclined some twelve degrees from the horizontal, dipping down toward the material to be excavated and rising above possible obstructions at the land end. This machine worked in both wet and dry material, when the water was in the canal in the summer and after it had been drawn in the winter.

Another type of machine we should notice is that called the ladder-dredge, the bucket-dredge or the elevator-dredge, all three names being applied to the same machine. But no claim for novelty can be made for this dredge or even for the combination used on the canal, that of ladder-dredge and of belt conveyor for carrying the spoil ashore. The most conspicuous of this type of dredge were the two on the contract which extended west from Oneida lake for about 42 miles. Two kinds of delivery belts were used on this con-



Channel in Genesee Valley park, Rochester, where to prevent despoiling the beauty of the landscape, structures of artistic design have been built, dikes and drains have been placed to preclude overflow and carry away seepage, and spoil-areas have been transformed into pleasing lawns.





tract. By one combination a dredge and a boat carrying a belt conveyor worked together and delivered the excavated material into scows, which were towed out into deep water in the lake, where they were dumped. By the other combination the dredge, an intermediate boat and a boat carrying a shore delivery belt were able to deposit the excavated material a hundred feet inshore at any desired height up to sixty feet above water and then to wash it still farther back some thirty feet. This machine also, with material dropping from the belt high in the air and so far from the shore line, presented an unusual sight. Another ladder-dredge, accompanied by a belt conveyor boat, was used for excavating in the channel west of Rochester. Here the new canal coincided with the old in alignment and the shore conveyor portion was of sufficient length simply to place the spoil back of the tow-path or berme banks.

From these descriptions it will be noticed how important were the devices for disposing of excavated material. In the construction of the Barge canal, as in any large enterprise of like nature, the problem of conveying excavated material to spoil-banks was often more perplexing than that of digging it and also involved greater expense. In addition to the conveying machines already described many ordinary and less spectacular methods were in daily use. The most economical way of handling much of the material was by means of hydraulic dredges and many such machines were on the canal. But these dredges were nearly all of standard type and call for no special description. One or two of the first of those to be put on the canal were peculiar in having cutters which revolved on a vertical rather than a horizontal axis, but the innovation did not prove very successful. Most of the suction dredges on the canal were of the 20-inch size. Some of them made good records; for example one had a little more than a half million yards to its credit for a month's work. In comparison with the boast of the early canal commissioners mentioned at the beginning of this chapter the amount is interesting. This dredge for a month was excavating as much material every 17 minutes as the three men together could dig in five and a half days. Or to put it another way — the dredge accomplished as much in one minute and two seconds as one of these men did in a full day.

A machine of quite different character, neither excavator nor conveyor, was the rock-breaker. This was a device for loosening subaqueous rock. In some places where there was rock to be excavated in the beds of rivers long stretches of the stream were coffer-

dammed and the work done in the dry, and in other places the material was drilled and blasted without being uncovered, in the latter case a boat carrying a battery of drills and operating engines being used, but in a few places the more unusual machine, known along the line of the canal as a rock-breaker, was employed. The principle of this method was that of loosening the rock from its bed by the impact of heavy blows. The shattering was accomplished by dropping from a considerable height a cylindrical hammer, 26 feet long and weighing between 15 and 16 tons. At the lower end of the hammer a removable section, in shape a conical point, could be renewed when worn out. The machinery was all contained within a boat that was held in position and moved by means of wire cables, anchored on shore. It was customary in operating with this device to move back and forth so as always to be working against a face of unbroken rock. After the rock-breaker had finished its work the broken fragments had to be removed by a dredge.

All of the machines thus far described have been in some way connected with the excavation of the channel. But from both an engineering and a popular point of view the structures on the canal are more interesting than the channel. When it came to furnishing machinery for building the structures, however, there was less opportunity for developing anything peculiarly striking or novel. But on one contract there was produced an appliance for conveying mixed concrete which was both striking and novel. Three locks of the Waterford series were built under this contract. These structures are all unusually large and also they are in close proximity, there being a distance of less than two thousand feet from the central lock to the farther end of either one of the other two. The economic handling of concrete in building large structures is a matter of importance of course on all occasions, but in this instance, because of the exceptional amount to be handled and the possibility of reaching all three locks without going far from a central mixing plant, the problem became one of uncommon moment. The solution in this particular case took the form of a plant in which belt conveyors did all the work of transporting materials, both before and after the concrete was mixed. Although belts had been used before for conveying materials to a mixer, this was probably the first instance of their use for carrying the mixed product to the place of deposit, at least for any considerable distance, and so the device was of especial interest.

A concrete mixer, of the Hains type, was placed about midway between two of the locks, at the center of distribution of approximately 100,000 yards of concrete work. Beside the mixer were railroad tracks of sufficient capacity to hold cars for supplying materials for 500 yards of concrete a day. The sand and stone came in bottom-dump cars, which delivered their loads through hoppers to the belts that ran to the mixer. There were bins for storing surplus sand and stone and these also were served by belts. From the cement storage house a belt ran to the mixer. All hand operations were thus reduced to a minimum. At the mixer itself a little handling was necessary; some shoveling was required in getting stone and sand from the ends of cars to the hoppers; the cement had to be carried into the house and then lifted to the belt when needed; but aside from these operations the belts did virtually all of the work.

From the mixer there extended a series of three long belt conveyors to the site of the lock, the longest being 600 feet in length. The first two conveyors discharged into hoppers, so as to feed properly to the succeeding belt and also so as to hold up the delivery of a whole or part of a batch of concrete in case of any necessity for shutting down quickly. These belts ran at a speed of about 450 feet per minute, but each succeeding one ran a little faster than its predecessor, so as to correct, especially on the long belt, any excessive loading at the mixer. The delivery at the lock was made through a huge tripper-car, which had a boom 45 feet long, carrying an independent belt. By moving this car along the length of the lock and swinging and raising or lowering the boom all parts of the work could be reached. Depending from the end of the boom swinging spouts of various lengths were used to collect all particles of the concrete to a narrow space in dropping them into the forms. This latter device, with its swaying motion, proved effective for good results, for, unlike any form of bucket which discharges a large volume quickly, with an outrush of grout incident to the operation, the belt and spout deposited the concrete gradually and secured a uniform consistency throughout the mass. Water piped to the end of the boom was at hand to be added to the mixture if necessary.

In operating the tripper-car certain hand manipulations were required, but aside from this all transportation from the mixer to the forms was done by power-driven machines. Electric current, taken from near-by lines, furnished the energy at this plant. In building the second lock under this contract the tripper-car was discarded and a belt line was run over each lock wall. Moreover, the

third lock was so far away that a train of cars was used between the mixer and a short line of belts.

Three or four other machines on the canal deserve a simple mention. At Fulton there was a floating concrete-mixing plant. At a lock near Rochester a long cableway bore the concrete in buckets from mixer to forms. During the latter part of canal construction there were several somewhat elaborate concrete-distributing plants of the high tower and long chute variety. These were not permitted during earlier construction, but canal work followed the trend of the time in this particular and conformed to what was then becoming a common practice. A rather novel contrivance was a bank-sloping machine, built for one of the Champlain contracts. Somewhat similar appliances were later used at other places.

Not all of the machinery employed in constructing the Barge canal can be said to have been eminently successful from the financial standpoint. Some of the elaborate devices cost very large sums and as they were often of novel design they received much publicity, but there is a question whether the contractor who used simpler and more usual means did not fare better in the end.

The machinery described in this chapter is not a tithe of that used throughout the whole canal. Few well-known varieties were lacking and often widely differing appliances were employed for doing the same kind of work. This fact was illustrated most vividly on the section just west of Lockport, where a greater variety of machines was found than on any other single contract. In walking over the line the first to catch our eye would have been the usual locomotive and train outfit. Then a set of guyed derricks swung their long booms from prism to spoil. Next, locomotive cranes, working in pairs, performed the same office. Again, an inclined track, with tippie at top and mounted on a traveling base, carried its cars from canal to bank. Also there was a cableway, with traveling towers adjustable as to distance between them. Still another form was the double-boom conveyor, which could be loading and discharging at the same time. These machines were all conveyors simply and each had its complement of drills and channelers and of steam-shovel, revolving drag-line excavator or other loading or digging apparatus. In addition there was also operating on the Lockport section the great cantilever crane, extending from the tow-path to the spoil-bank behind the berme. But variety of machinery is not the theme of this chapter. Rather the purpose was to describe noteworthy specimens and the most conspicuous of these have now been mentioned.

CHAPTER XXVII

STATE WATERWAYS ASSOCIATION

*Need for Body of Canal Supporters—Organizations during Agitation—
Formation of State Association—Its Place in Canal History—Its
Members Men with Altruistic Ideals—A Tribute to Them.*

WE HAVE said that after the authorizing act of 1903 the canal passed from the hands of the advocates to those of the engineers. Perhaps this would seem to imply that the project had no more need of such support as its well-wishers had been giving. But this was not the case. The Barge canal has been a growth, a product of development, an evolution, and as the various accretions have come, the waterway has assuredly needed a strongly-organized body of friends—to create public sentiment, to secure the passage of new legislation, and to guard and forward its interests in many other ways. Doubtless the association which was formed for doing this work has not met these needs to the full nor even attained to the goal of its high aims, but it has done much; for one thing it has held the banner around which on emergent occasions canal forces might rally, and for what it has done it deserves praise.

During the period of Barge canal agitation there had arisen a rather numerous company of supporters and these were drawn largely from among existing commercial, industrial and civic bodies. At the forefront stood the men who had been members of the canal organization that had existed under several names and with a few interruptions since 1885. For pressing the claims of the Barge canal during the stage of its agitation these various elements had become somewhat closely associated, but when construction work began this organization, never united on a permanent basis, fell apart. Possibly these men themselves, although as individuals most of them remained active, deemed their mission as an organization accomplished. However that may be it was 1909 before formal association was effected.

At the time of beginning the Barge canal and also during the years that have followed, there has been abroad in the land, as we have seen, a well-pronounced and wide-spread movement for waterway improvements. New York was leading the states in actual accomplishment and it naturally followed that she should have a waterways association. Other such organizations had been founded in

those years; there was the National Rivers and Harbors Congress, country-wide in its interests and its membership, and the Atlantic Deeper Waterways Association, which embraced all the Atlantic seaboard states, so why not an organization in the state that was doing most in waterway construction?

Delegates from New York state at the fifth annual meeting of the National Rivers and Harbors Congress at Washington on December 9, 1908, formed a temporary organization and authorized a committee to formulate plans for a New York State Waterways Association. This committee had a meeting in Albany on the 13th of January following and another in New York city a week later. At the same time as the latter meeting there was held a conference under the auspices of the Manufacturers and Business Men's Association of Brooklyn, which was well attended by delegates from various parts of the state and at which numerous carefully-prepared papers on a wide variety of waterway topics were read. It was at this conference that the permanent organization was effected. Its president for the first year was Robert J. MacFarland of Brooklyn, and for the second year, Patrick W. Cullinan of Oswego. Then Henry W. Hill of Buffalo was chosen president and he has been reelected each succeeding year to the present time.

It is not our purpose to discourse at length upon the New York State Waterways Association, but this organization has had an important place in Barge canal history and still has a place of influence in canal economy, and to understand that history we must be cognizant of the existence of this association and also appreciative of its work. It came into being just in time to lend its aid to the projects of the Cayuga and Seneca improvement and the canal terminals. It has helped to secure whatever other additions have been made to the canal scheme, such as funds to complete the waterway after the original money was exhausted, Hudson river terminals, grain elevators, a canal traffic bureau, a law to secure harmonious relationships between railroads and canals, appropriations for additional canal surveys, investigations to further the schemes for Federal waterway construction in the state, and the improvement of the Harlem river and the Bronx kills. The Association has also backed many projects, both State and Federal, that as yet have not been undertaken, such as a Deeper Hudson, the construction of the Long Island south coast canals, the Black River extension and the Flushing-Jamaica canal, the reconstruction of the Chemung canal, the enlargement of the Glens Falls feeder and the construction of an

international canal from Montreal to Lake Champlain. It urged Government use of the canal in the time of war emergency and when that control proved detrimental it was loud in its demand for a return of the canal to the State. It has tried to stimulate greater use of the canal since its completion and just now it is panoplied for the battle against United States participation in constructing the St. Lawrence ship canal.

Although the annual gatherings of this Association are not attended by numerous delegates and while much that is said at these meetings may not be followed by effective action, the body really has a rather large constituency, including most of the commercial and industrial organizations of the state with their large memberships, and on occasion it can wield considerable power. Its latent possibility of influence, moreover, has been one of its chief virtues. It has sometimes happened that there has been urgent need for quick action in supporting or opposing State and Federal legislative enactment or in other emergent crisis and then the organization has been at hand, ready to respond to the call. That the members of the Association are generally men who have no personal interests at stake in the measures they recommend has added greatly to their influence. Sometimes it has happened that public officials on whom has rested the responsibility of approving or rejecting certain projects have looked to this organization for an unprejudiced opinion on the merits of these propositions.

We would speak not alone of this waterways association but also of the men who make up its membership. Although comparatively few in numbers, some of them have been the faithful few who could be counted on always to uphold to the utmost of their time and ability anything which promised for the public good in the way of waterway improvement. With no chance for personal gain, without even the incentive of much honor, their disinterested espousal of the canals has been an inspiration. Waterways to some of these men have become a passion; they might almost be said to be an obsession, but that word poorly describes their state of mind; moreover it is banal. But whatever the controlling motive it surely is altruistic and the result has been that the State has benefited by their unselfish zeal.

It seems fitting to quote here what appears to be an almost unconscious tribute to these men by one who is known as the Nestor of canal advocates, one who for about forty-five years has been at the forefront of canal agitation, George Clinton, grandson of

DeWitt Clinton. Mr. Clinton spoke these words when he was called upon to address the State Waterways Association a few years ago.

"Your praise gratifies me," said he, "but always brings tears to my eyes when I think of the noble men who have gone to the shadow of death, who worked shoulder to shoulder thirty years ago with those of us who began the agitation. Well, gentlemen, we have done our work. Some of us are growing old. The young men in the community must be induced to take an active interest in these matters, to study them and to devote their time, such as they can spare, to the public interest without hope of either reward from the public treasury or honors in office."

CHAPTER XXVIII

ADVERTISING THE CANAL

Publication of Barge Canal Bulletin—Akin to Canal Record and Reclamation Record—Barge Canal, Like Panama Canal, in Need of Creating Favorable Public Opinion—Services of the Bulletin: Spreading Information to the General Public: Keeping Contractors in Touch with Construction: Preventing the Repetition of Experience Like the Nine-Million Scandal: Encouraging a Spirit of Loyalty—Lectures Used—Exhibits a Valuable Means of Publicity—Various Expositions—Nature of Canal Exhibits—Highest Award at Panama-Pacific Exposition—Newspaper and Magazine Publicity—Need of More Advertising

THE MODERN business man believes in advertising. If he did not, the success of his competitors would soon convince him of his error. The State is sometimes charged with not conducting its affairs according to business methods, but, be that as it may in the main, it is true that in connection with Barge canal construction the modern business practice of advertising was employed. At least such an attempt was made, but whether the means used went far enough to accomplish all that was desired is doubtful, especially in the light of certain recent happenings.

Several channels of publicity were employed. Probably the most effectual was the issuing of a monthly publication by the State Engineer. This was called the *Barge Canal Bulletin* and its publication ran for just eleven years, beginning with the February, 1908, number and ending with that of January, 1919. The State Engineer was not alone in using this means for reaching the public ear in matters of public concern. At various times, often for terms of several years and sometimes for only short periods or even intermittently, many State departments have had their regular or occasional publications. Federal departments have done the same. Aside from the right of the people to know how their affairs are being administered, heads of departments find that it pays in both financial and moral support to keep the public informed. The publications most nearly akin to the *Barge Canal Bulletin* were the *Canal Record* and the *Reclamation Record*, the former the official Panama canal publication, the latter the monthly periodical of the United States Reclamation Service. The *Reclamation Record* did not begin publication until about two years after the first *Barge Canal Bulletin*

appeared, but the *Canal Record* antedated the *Bulletin* by five months, its first issue being that of September 4, 1907.

The *Canal Record* was a weekly publication and it differed somewhat in character from the *Barge Canal Bulletin*, serving to keep the Panama canal builders in touch with general activities on the Isthmus as well as those of construction, but this was the publication which inspired the State Engineer to issue something of a like nature. It was at the suggestion of a Federal engineer who had been engaged on early Barge canal construction that State Engineer Skene founded the monthly which his successors continued until the canal was completed in all save a few minor and incidental details.

In the history of the Panama canal there came a time when the people of the country were beginning to be dissatisfied. Things were not going smoothly on the Isthmus and changes of administration were taking place. It is said that President Roosevelt at this time determined on a plan of wide publicity, to turn the tide of popular sentiment. The *Canal Record* was one feature in this campaign; a most active press bureau, which reached to almost the last newspaper in the land, was a more effectual means. It is known by all how well this plan succeeded and much credit is due the President for conceiving the idea and boldly carrying it out, but he had a powerful ally in the nature of the enterprise itself. The Panama canal had all the elements of popularity—the romance of the Spanish conquest and of all the early days; the colossal failure of De Lesseps; the adoption of the project by the United States; its office in joining the two great oceans; its world-wide fame; its dimensions, admirably suited to tickle the American pride; the enchantment of distance from home. The Barge canal had as much or greater need for a favorable public opinion. By many and with good reason it is considered a greater engineering feat than the Panama canal, but like the prophet in his own country its home state has been foremost in failing to appreciate both its greatness and its importance. It had no such catalogue of characteristics to appeal to the imagination. In the early days of the Erie canal there had been romance in the thought of connecting the great inland seas with the ocean, but somehow that sentiment had worn threadbare. There was no glamour of the distant and the unseen. Moreover there was the very real handicap of former disfavor, a feeling which people had not forgotten or through prejudice did not want to forget. To succeed in a campaign of publicity for the Barge canal involved many difficulties the Panama builders did not have to contend with.

When the *Barge Canal Bulletin* was started there was no precedent for just the kind of publication it was thought this should be and a policy had to be worked out. Also a mailing list had to be secured and this was done by first making an initial list through a general knowledge of those persons already interested and those who should become interested in the canal and then continuing in an attempt to interest others to the point of their asking to have copies sent to them. For undertaking these tasks the State Engineer selected the writer of the present volume, since he had been in the department many years and had a rather broad acquaintance with the whole canal scheme, especially through his work as author of the former canal history, which had but recently been published under authority of State Engineer Van Alstyne. The editorship of the *Bulletin* remained the same throughout the period of its publication.

The purpose of the *Bulletin* was to give to the citizens of the state authoritative information on the whole project — what progress was being made in construction and how the money was being spent. From time to time also articles calculated to be of popular interest were published and often these were copied by the public press. In fact it was rather surprising to see to what extent the papers of the state reprinted items from the *Bulletin*, items of general interest almost without fail and often items of local interest, even the prosaic descriptions of what the contractors in the vicinity were doing.

The *Bulletin* was a boon to contractors and to those having materials or machinery to sell. It contained information on the preparation of plans, the advertising and awarding of contracts and the bids that were submitted, and so became a complete calendar for their guidance. Although the law required the advertising of a contract-letting in certain newspapers and engineering periodicals, there can be no doubt that the *Bulletin* gave material aid in securing wider competitive bidding and so helped to reduce the cost of construction. Incidentally, by keeping the contractors and indeed the whole public thus informed, the *Bulletin* saved a deal of correspondence that otherwise would have added a considerable burden to the departments of the State Engineer and the Superintendent of Public Works.

But the mission of the *Bulletin* was wider than the mere company of those who had business relations with the canal. Care was taken to send it to substantially the whole press of the state. On the mailing list were chambers of commerce and industrial organizations,

libraries and educational institutions, State and municipal officials, technical, business and social societies and a host of individuals. The edition reached a maximum of about sixty-three or sixty-four hundred. While the bulk of those receiving it lived in New York state, its circulation was by no means confined within state boundaries. Many copies went far afield, even to the ends of the earth. Probably it would have been better if more copies had gone to other parts of the country, especially to the territory surrounding the Great Lakes, and perhaps more care should have been taken to show to the people of that region how they might be benefitted by freely using the waterway after it should be completed.

There can be little doubt that one incidental good of the *Bulletin* was its service in making almost impossible a repetition of the ignominy attending the nine-million improvement. In spite of the Barge canal being the State's most stupendous project there has been scarcely a whisper of fraud or improper conduct during its whole construction. To be sure there has occurred little or nothing to give color to any charge of such character, but to one who has been connected with both canal enlargements the easy possibility of a different story is apparent. Very few persons know how the nine-million scandal started. The desire of a discharged engineer for revenge, without caring whom or what he injured, was at the bottom of the whole disgraceful affair. The investigating commission found little that was blameworthy, virtually nothing so far as the engineers were concerned, but the sinister stories, once given utterance, kept on going, and some of the engineers were ruined professionally and the canal received such a staggering blow that it has hardly yet recovered. But the point of the recital is that without knowledge of actual facts the people of the state could not discern between just criticism and calumny. If a policy¹ had been adopted of sending broadcast reports of the improvement and its financial standing, it is quite believable that the whole unpleasant experience might have been avoided.

Another incidental benefit was the *esprit de corps* which the *Bulletin* tended to foster among the many engineers and other employees engaged in prosecuting the work. By getting a more comprehensive view of the entire project these men could labor together more harmoniously, to the advantage of the whole work and the mutual benefit of all concerned. This spirit of loyalty and pride might well have been encouraged much further. At Panama it was so encouraged and the good results were apparent.

Another instrument of publicity was the lecture. Some of the engineers had the ability to speak in public and, assisted by lantern slides or motion pictures, they interested many an audience gathered under the auspices of some organization. In making a pictorial record of progress hundreds of photographs of the work have been taken and it was easy to prepare very attractive sets of lantern slides. Some of the machinery used in building the canal was of novel character, as we have seen, and lent itself to rather unique film productions. Motion picture companies were induced to photograph canal construction and to send these views upon their circuits and incidentally to furnish a reel for State official use. Thus by way of supplying a pleasing entertainment the lecturers were able to do a valuable work in canal education, and this means of publicity also was carried beyond the state confines.

Yet another means of advertising the Barge canal was the sending of exhibits to various state, national and industrial expositions. Many thousands of people were thus enabled to learn through a pleasant diversion something about the canal. As the expositions lasted from a week or two to well towards a year, as in the case of the national shows, and as there were thousands of visitors each day, the number of those reached ran up into the hundreds of thousands. Annually for about eight or nine years the State Engineer had exhibits at the New York State Fair. Then there were numerous exhibits at various industrial expositions in New York city and elsewhere; also one at the International Navigation Congress in Philadelphia, one at an Atlantic Deeper Waterways convention in New London and another at a Middle Western meeting in Pittsburg. Besides these there was an exhibit at the Alaska-Yukon-Pacific Exposition at Seattle in 1909 and the most elaborate exhibit of all at the Panama-Pacific International Exposition at San Francisco in 1915. In all there were more than a score of these occasions, and at each place, except Seattle, from one to a half dozen representatives of the State Engineer's department were in attendance. These exhibits were not small and most of them required several months for preparation. They were made possible by money for expenses being furnished by the organizations under whose auspices they were held. On a few occasions portions of them were loaned for still other expositions or fairs.

Early in the experience of preparing these exhibits it was perceived that they had to be such as would make a strong appeal to the passer-by at his first glance, and then interesting enough to hold

his attention. Models of noteworthy structures or of portions of the canal seemed to serve this purpose and moreover an exhibit of this character could be made to furnish such information as it was desired to impart. The models were always workable and generally the working was done in part by hand, rather than being entirely mechanical, and therein probably lay the secret of their appeal, for people seem to be interested most in that which has about it the personal touch. That these exhibits attracted the people was attested by the crowds that generally stood in front of them.

A few words in relation to the Barge canal exhibit at San Francisco are pertinent here. In announcing the prize given to this exhibit the *Barge Canal Bulletin* explained that this award was not only a recognition of the exhibit but also an appreciation of both the canal itself and the place it occupies among the engineering enterprises of the world. For this reason it seems well to quote the *Bulletin*.

"It is a source of considerable satisfaction," it said, "to those who have been connected with the construction of the Barge canal that the international jury of awards at the Panama-Pacific Exposition has recently granted the grand prize, or highest award, to the Barge canal exhibit. A detailed account of this exhibit was published in the February *Bulletin*. A comparatively small amount of money was available for making the exhibit and consequently it could not be entirely comprehensive, but the jury took into consideration the Barge canal as a project as well as the exhibit itself, and thus this award becomes a distinct recognition of the canal as one of the greatest engineering feats of its time, since it receives the same award as its two chief rivals at the exposition, one being the United States Government exhibit, which occupies half of an entire building and contains models of all engineering features undertaken by the Government in recent years, and the other the Panama canal zone concession, which is a replica of the Isthmian canal, covering more than an acre, costing \$400,000 and built for financial profit, a charge of fifty cents being charged for admission. Besides these two rivals, the Barge canal had formidable competitors in the exhibits of foreign governments, other states, New York city and large corporations.

"When in a former announcement the jury had granted simply a gold medal to the Barge canal exhibit, a protest was made, both by the State Engineer and his representative at the Exposition, and by the New York State Commission. The protest was entered on

the ground that it was unfair to make this exhibit compete with those costing more than twenty-five times as much or with money-making concessions. The apportionment for the Barge canal exhibit was only \$15,000 and this sum had to cover the cost of making, transporting and installing its various parts, building its enclosing booth, furnishing considerable electric power and water for operation and supplying two and part of the time three competent men in attendance during the ten months of the Exposition, including their salaries and the salaries and traveling expenses of three men sent for the installation. The rates on models and the distances are such that the item of transportation alone was about a thousand dollars. Thus only about half of the appropriation was available for the preparation of the exhibit itself.

"In response to the protest the jury reconsidered its decision and did better even than it was asked. It did not simply put the Barge canal exhibit at the head of a class in which it was contended it might justly compete, but it gave the exhibit equal rank with the United States Government exhibit and the Panama canal zone concession.

"In making the award the problems arising in making the models were taken into account and it was decided that, although the models were fewer in number and smaller than in some other exhibits, more ingenuity was shown, as much even as would be demanded in making the original structures or machines they represent. In this reconsideration also, as has been stated, account was taken of the project which the exhibit portrays. The supreme engineering skill demanded in its design and construction was recognized, the multitude of difficulties overcome was considered and its rightful place among inland canals was acknowledged in the award of the highest honor, the grand prize."

For the past seven or eight years the State Engineer's department has had connected with it one or two men who formerly were in journalistic work and had had a thorough newspaper training. These men have used their earlier experiences for the benefit of the canal and have been able to do a large amount of valuable publicity work, sending to the daily press news items and also both signed and unsigned articles of general interest, and contributing to scientific papers writings which have interested the student or more often to the magazines such articles as have had the popular appeal.

The advertising activities we have described were carried on chiefly by the State Engineer's department. Other departments

have sometimes assisted. The Superintendent of Public Works and his traffic bureau have done this, but their participation has been largely in the latter years of construction, during the period since the canal has been nearly or quite completed. Of course there has been a vast amount of publicity in which the State has had little or no direct share. Numerous canal articles have been published in popular and technical periodicals and the newspapers have been printing editorials and news items for many years. Whenever canal officials have been asked for help in preparing these articles or for photographs to illustrate them, they have gladly complied. In the recent agitation for a St. Lawrence ship canal the Barge canal has received much incidental publicity. It may be that the advertising from this source will serve better than anything that has gone before to awaken the people of New York state and make them more appreciative of their own canal.

In all of this advertising, particularly that in which the State has been engaged, there has been back of it one main purpose — to do whatever might best help to build up canal traffic after the waterway should be completed. It would seem that the shippers of the state should all have heard of the benefits of water transportation by this time. The canal, however, is not yet being used to the extent it should be. There are reasons for this, but perhaps considerable advertising must still be done in our own state. It would seem also that shippers beyond the state boundaries should by now have had some adequate conception of the Barge canal and be willing to give it a trial. But probably the radiant halo of the ship canal idea has been only dimmed, never lost in the Middle West and whatever messages concerning New York's canal have reached the people of this locality have not fallen on receptive ears.

CHAPTER XXIX

THE CANAL AND A DEEPER HUDSON

The Hudson an Integral Part of State Waterway System—Deeper Hudson Project Springs from Barge Canal—Close Relationship between Canal and Proposed Deepening—Congested Port at New York Furnishes Reason for Project—Other Inland Seaports—Arguments Advanced: Favorable Terminal and Factory Sites at Head of River Navigation: Best Distributing Point on Atlantic Slope: Commerce Already Large and Likely to Increase Enormously: Improvement Needed by Interior Points: Easily Accomplished: Railroad and Steamship Efforts Unavailing: Other Port Facilities Inadequate and Expensive to Increase: Water Transportation Cheapest: Improvement Feasible from Engineering and Commercial Standpoints: Saving on Rates Would Pay for Undertaking—Attitude of People of Capitol District—Present Status of Project—The Scheme One of National Significance.

THE TERMINUS of the Barge canal nearest to the ocean is still one hundred and fifty miles away. In the bed of the Hudson river at Waterford lie the eastern end of the Erie branch and the southern end of the Champlain branch. From this point of junction the Federal government has carried the canal about five miles down the Hudson to Troy. So far as work done by either State or Federal authorities on the project known as the Barge canal is concerned it ends at Troy, and this point, as just stated, is a hundred and fifty miles from New York. The condition of the channel in the Hudson south from Troy, therefore, is all-important to the New York canals. As a matter of fact this portion of the Hudson is really an integral part of the State waterway system, but until recently it has not been customary so to regard it, and moreover even yet the Barge canal is considered as ending at Troy. Whatever improvements have been made below Troy are looked upon as separate schemes.

Tidal navigation extends all the way up the Hudson to Troy. As far north as the city of Hudson the river has a depth of at least twenty-three feet, but above that point it becomes much shallower and as a result artificial improvements have been necessary. Until 1891 the State made whatever improvements were attempted. Then the United States assumed control. The work it has done to improve navigation has been considerable in extent and among its undertakings has been a channel equal in depth to that of the Barge canal.

Growing out of Barge canal construction, however, there sprang up an agitation for a much deeper channel in the Hudson, deep enough in fact to accommodate ocean vessels. The sponsors for the movement were the cities near the head of navigation, Albany and Troy chiefly. At first these two cities were working at cross-purposes; Albany wanted the deep channel to stop at its own waterfront, lest it should not reap the full benefit of being the transfer point, while Troy was not satisfied with anything less than a full depth channel to the dam which stood both at the head of tidal navigation and at the southerly end of the Barge canal. Later these divergent aims were pooled, and out of this common desire there has grown a community of interests which include many other public objectives as well and affect a widened circle of territory, one embracing Albany, Troy, Schenectady, Cohoes, Waterford, Watervliet, Green Island and Rensselaer, and come to be known as the Capitol District.

This project for a "Deeper Hudson," as it is called, has gained wide publicity and also a backing of considerable strength. It is an enterprise which falls under Federal jurisdiction and as yet has not reached the stage of authorization. But although the scheme was launched early in the period of Barge canal construction the interested cities have still retained their zeal and year after year their delegates have attended the conventions of the State Waterways Association, the Atlantic Deeper Waterways Association and the National Rivers and Harbors Congress, and these bodies have as regularly given the project their recognition and endorsement.

Albany and Troy took the lead in championing a river channel deepened for ocean vessels, but early in their campaign they gained added strength through enlisting other Hudson river cities in the enterprise. There resulted an organization known as the Hudson River Improvement Association, which advocated a 22-foot channel in the Hudson as far north as the end of the Barge canal. Subsequently the depth of channel sought was increased to 27 feet.

It readily appears that the relationship between the Barge canal and a Deeper Hudson is very intimate. Since together they would constitute an important connecting link between the Great Lakes system of waterways on the one hand and the ocean and the chain of intracoastal canals on the other, the project assumes a national or even an international aspect. The State and its various officials have given the enterprise their approval. If ocean vessels could meet canal craft at Albany or Troy, the whole scheme of canal

traffic would be greatly altered. In any study of the Barge canal, therefore, it becomes necessary to know the essential facts in regard to the proposed deepening of the Hudson and also the reasons which have been put forth in support of demands made upon the Federal government for performing the work.

It cannot be gainsaid of course that the promoters of this scheme were influenced primarily by a desire to advance the welfare of their own communities, but the insufficient terminal facilities and the resulting congestion in all commerce at New York city formed the foundation on which to build this framework of an inland seaport. Conditions in New York were already serious and the outlook at that time did not hold any hope for adequate future improvement. Students of transportation declared that with the opening of the Panama canal New York was in position to become the supreme seaport of the world, the meeting place of commerce from the East and the West, from the cities of North and South America, from the Orient and Europe, the great point of transshipment in the Occidental and Oriental trade. With these conditions and this prospect in view the advocates of a seaport at the head of tidal navigation laid their plans and advanced their arguments.

Such an inland seaport was not without precedent. Europe furnished several examples. There was Manchester, which was reached through a ship canal thirty-five miles long, on which there were five sets of locks. Its commerce had grown from nothing to large proportions. Hamburg was about eighty-five miles from the sea. The improvement of the Elbe river made it a seaport and ships from all the ports of the world were reaching its docks. Amsterdam, at one time the greatest port in the world, was an inland port about seventeen miles from the ocean and was reached by a canal which had a lock at the sea entrance.

In order that a locality may become an important port it must have at least the following three qualifications: Its topography must be such as to permit the development of large docks, terminals and transshipping yards; it must have good distributing facilities by either rail or water or both; it must have a rich hinterland with either a commerce already developed or one that can be developed by the proposed improvement. The Capitol District, so the promoters held, possessed all of these advantages.

In substantiation of these and other claims the sponsors have conducted a campaign of education, publishing literature from time to time. A few transcripts or summaries from these pamphlets will

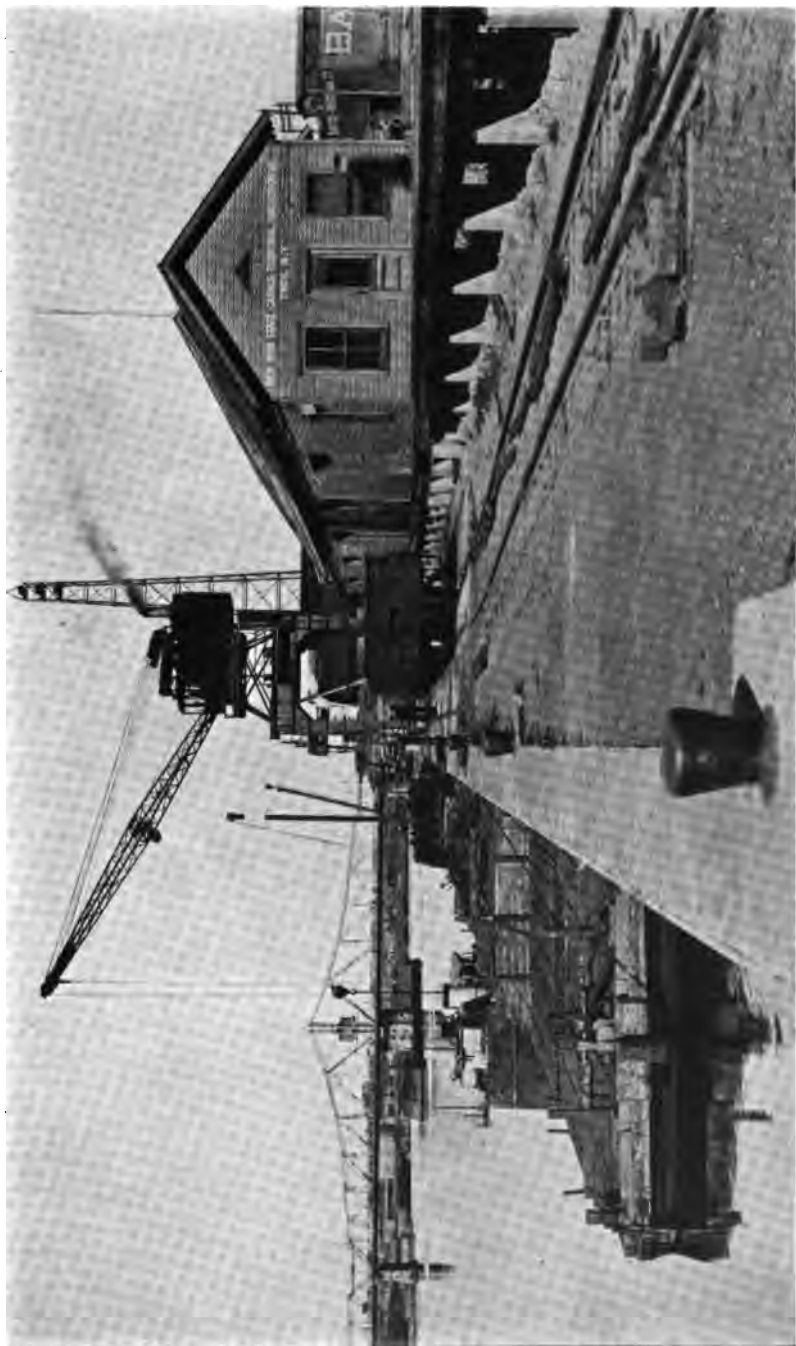
best contribute to a comprehensive understanding of the whole project and will also reveal the arguments in its behalf. The following discussion is such a summary.

In the Capitol District there are at least ten square miles of cheap, flat, bottom lands lying adjacent to railroad terminals and well situated for docks and factory sites. Terminal charges would be much lower here than in New York, where land values are excessively high.

This district is unusually well provided with shipping facilities, being a railway and canal center. Here meet important lines from the west, east, north and south. The Boston and Albany, the Boston and Maine and the Delaware and Hudson railroads reach into New England and Canada; the New York Central four-track road and the West Shore double-track line connect with the Great Lakes and the Middle West, also with New York city; the Delaware and Hudson extends into the coal fields of Pennsylvania; the district has more freight and passenger trains daily than Buffalo, showing its importance as a railroad center. Here meet the eastern terminus of the Erie canal and the southern terminus of the Champlain canal. No other point on the Atlantic slope is so favorably situated as a distributing center for commerce destined for the Great Lakes and the north central states by either rail or water.

The commerce of this locality is already important both in tonnage and value, the amount available for river transportation exceeding the accommodations offered and being diverted in part to other channels. The commerce in the river would be enormously increased by the Barge canal. Northern New York is already a very important manufacturing district and this territory is yet far from being developed. The Capitol District is capable of large development. Contemplated water-power installations would furnish ten times the amount of power already used, making possible the building up of a vast manufacturing center. It possesses unusual advantages for becoming a large lumber-distributing mart. With sea-going vessels reaching its ports this district would become the natural outlet for all Canadian trade with South American and Pacific ocean points and might attract much other Canadian commerce.

To allow the country at large and especially the region between the Mississippi river and the Atlantic seaboard to reap the benefit of the Panama canal, sea-going vessels should penetrate to the terminus of the Barge canal.



Terminal at Troy, the point of transfer with New England. A full portal steam crane is shown. This is equipped with a lifting magnet. At the dockwall lies a barge carrying steel rails, which are being transferred by means of the magnet. There are rail connections at this terminal with the Boston and Maine and the New York Central railroads.





The Hudson is a natural arm of the sea, navigable for 120 miles of its length to most ocean-going vessels. In this portion it has a width of at least 600 feet and generally is much wider. The improvement of the remaining thirty miles would involve for the most part soft excavation at a light cost. The stream is tidal and requires no lock and there would be no question of adequate water supply.

Railroad and steamship companies had done their utmost to hasten shipments from producer to consumer, having built great terminals and increasing enormously the rate of speed, only to have their efforts largely made void by the delays due to congestion.

The port facilities along the Hudson and especially at New York city were inadequate and the cost of providing suitable facilities at New York was so high as to be almost prohibitive. The cost of a single pier there would build a whole system of terminals in the Capitol District. Even if these facilities were provided, the question of rail transportation to interior points was still unsolved.

As haulage by rail costs ten times as much as by water, a seaport 150 miles inland would effect a considerable saving, since the distance by rail to interior points would be materially lessened.

The project of deepening the Hudson to 27 feet was entirely feasible and presented no difficult engineering features. The cost of maintenance and operation would be exceptionally low for a scheme of that nature. No unusual hazards to sea-going ships would be found in navigating this river and it was possible to make a channel of greater width than common for canalized rivers. A large part of the freight originating at points along the Great Lakes could be brought to the Hudson by water without breaking bulk. Large shippers and ship-builders were already working on designs of steel vessels that could use the Barge canal and yet be seaworthy on the Lakes. Freight handled thus could be brought to the Hudson for about one-tenth of what the railroads would charge. After reaching the Hudson the goods destined for export could be handled more cheaply on vessels of deeper draft.

The saving in freight charges on freight destined to interior points would be large and as the amount of freight affected by this saving was immense the resulting benefit to the country would be enough to pay many times the total cost of the undertaking.

Such are the arguments which have been advanced by the friends of a Deeper Hudson. The press of the Capitol District has been most persistent in its advocacy of the project, never letting an oppor-

tunity escape for upholding the cause in strong editorial or pertinent comment. As a result the people of the region are arrayed in almost solid ranks for its support.

It will be noticed that some of the arguments advanced by the Deeper Hudson advocates do not accord with the principle underlying the Barge canal theory, namely, that a transfer of freight from lake to canal boat, each designed especially for its own particular channel, is more sound economically than a shipment without transfer on a boat which tries to navigate successfully both types of channel.

The Federal government seems to have taken the stand which its engineers assumed several years ago in reporting on this project, namely, that although this river is a very important waterway and at some time it will be advisable to deepen it to at least 27 feet, for the present nothing should be done.

The citizens of New York state have long felt that their treatment at the hands of Congress in the matter of appropriations for river and harbor improvements is far from just, that more than five or six per cent of the total of such appropriations is deserved for supplying the facilities to handle one-half of all the foreign commerce of the country. The exports and imports which pass through New York are not simply of local concern; they affect the whole nation. So too the Deeper Hudson is a scheme of national significance. In spite of long delay its advocates are still hopeful that eventually their desires will be realized.



CHAPTER XXX

THE CANAL AND THE PORT OF NEW YORK

Port of New York Preëminent in World—Changes Taking Place—Port and Canal Interdependent—Canal Participation at Inception of Port Improvement—Canal Construction at the Port—Coöperation between New York and New Jersey an Outgrowth of Harbor Case—Creation and Work of Bi-State Commission—Port Authority Created—Treaty between States Ratified by President—Work of Port Authority—Principles Governing Solution of Port Problem—Outline of Plans—Need of Haste in Undertaking Work.

THE STATE canals have played no small part in making the port of New York what it is today — without a rival in America, outranking all ports of the world in volume and value of its commerce. So long has this been the greatest port of the country that it is hard to realize that it did not always enjoy this exalted station. But before the original waterways were built New York ranked in second or third place and there can be little doubt that the canal was the chief factor in effecting the change. Indeed it is commonly conceded that the two predominant causes in making this the greatest port on the continent were, first, the topography of the port itself, and second, the canal. Nature's gift was the safe harbor with its 800 miles of shore line, where piers, docks, warehouses and other shipping facilities might be built and where industrial sites might be found. Man's contribution was the canal. Later came the railroads and this trio of propitious causes placed the port far in the lead and moreover they have kept it there ever since and also have made the city the mighty metropolis of the western hemisphere.

In the early days of its existence and even until 1870, according to an eminent authority,* the Erie canal possessed such a large influence over the port of New York that its success depended primarily upon this waterway. But as the railroads came and grew and as there entered and multiplied other factors in determining this control, the canal dominance dwindled to but a fraction of its former strength. Now, however, the canal has been transformed into an

* Professor Emory R. Johnson in testimony in the New York Harbor Case.

efficient modern avenue of transportation and following in point of time this canal rejuvenation there is taking place a like transformation in the port itself. It cannot be said that it is the influence of the canal alone which is bringing about this change in the port, the present canal influence is by no means powerful enough for that, but these improvements in both canal and port are very closely allied and moreover it is doubtless true that they are due in large measure to common causes. The revival of interest in waterways has been world-wide. For a long time it has been known that in America our transportation systems have been inadequate and year by year have become less and less able to meet our needs. Facilities for commerce in our metropolis have been admittedly so poor that trade of necessity has had to seek rival ports. All this could lead to but one result, a congestion ending often in stagnation. Such are the common causes which have wrought the changes in canal and port — a revival of public interest and a situation so acute as finally for self-preservation to compel improvements. But there has been a recent and peculiar manifestation of the causes underlying the improvements in canal and port, and this has affected the State in part but the city more especially. The inadequacy of facilities and the increasing acuteness of congestion at its chief port have long been borne by the business interests of the country with such patience as could be mustered, but finally a storm of protest, after years of threatening rumblings, has burst in full fury. New York city at last has begun to realize its peril. As United States Shipping Commissioner Love recently said, in speaking before the Port Authority, New York has lost the cotton trade and also the tobacco trade and is fast losing the grain trade. As another recent speaker * has put it, the country is demanding drastic remedies so that it may be freed from the tremendous burdens that have been placed upon its commerce because it has permitted the continuance of conditions which have forced the foreign business of the country largely through, what he terms, the archaic port of New York. A score of years ago the State of New York saw on the horizon the signs of this coming storm and as its contribution to a solution of the problem has constructed a modern canal with numerous well-equipped terminals and a capacious as well as extremely necessary grain elevator in the port of New York. Some five years ago the city of New York made its first effective move toward adequate port

* Congressman A. P. Nelson, in a speech made in the House of Representatives on December 5, 1921.

improvements. But it is since that time that the storm has burst. We cannot help wondering whether the city, feeling secure in its possession of half of the nation's export and import trade, has waited too long in bestirring itself. But however that may be, it was to relieve the paralyzing congestion and retain its trade that the world's greatest port planned its improvements and now, spurred to greater efforts by threat of misfortune, is endeavoring to carry its plans into execution. The port of New York has heard the cry of the West for other outlets and this has become a large contributing and impelling incentive for activity.

In addition to a oneness in causes the Barge canal and the port of New York have much else in common. The relationship between them is very close. The success of the port is not entirely dependent upon the existence of the canal, although the canal does have an influence and a rather large influence, both because it can contribute a considerable volume of commerce and because it acts as a potent regulator of rates. But on the other hand the success of the canal is largely dependent upon the efficiency of the port. If delays and high costs in delivering or transshipping freight at the port nullify the advantages of water transportation or turn traffic to other channels, the canal suffers.

The Barge canal moreover had a peculiarly intimate connection with the port improvement scheme at the inception of its present effective stage. The development of the port of New York has been a work of many years and its history of course contains numerous incidents, but the present phase, the adoption of a policy which at last seems to hold promise of being fundamentally sound and sufficiently broad to work out the salvation of the port, is of but a few years standing. This phase may be said to have had its beginning in what is known as the New York Harbor Case, a case heard before the Interstate Commerce Commission in January, 1917, in which the States of New York and New Jersey were pitted against each other. In this case the influence of the canal on the port—how New York State had contributed toward building up the port by constructing, improving and maintaining its canals for a hundred years and what the State was then doing in the huge modern canal improvement—held a prominent place in the evidence presented. Also State Engineer Williams was an important and valuable witness. Furthermore, one of the lines of evidence on the New York side attempted to show from a study of the statistics of population and of commercial and industrial growth that New York was almost entirely responsible for the development of the

whole port, the New Jersey portion included. This study was suggested to New York's chief counsel by the chapter in the *History of the New York State Canals* on the "Influence of the Canal" and the State Engineer was asked to furnish the men to make the study. The author of the present volume, because of his connection with the former history, was one of the two men assigned to this task.

The success of the Barge canal, as we have said, goes hand in hand with that of the port of New York, and because there is this mutual relationship between the two it is essential to a complete understanding of the canal problem that we know past and present conditions in the port and also the plans for the future.

Even in the canal project itself there was included a comparatively large New York port improvement. Nearly half of the original appropriation for canal terminals was spent on the terminals in New York city and this sum was materially augmented by an amount for a large grain elevator at one of these terminals, a structure vitally necessary for New York's retention of its grain trade and the only elevator not dominated by strict railroad control. Before the Barge canal was constructed New York city's perfunctory and almost useless provision for canal traffic had become a jest and a by-word, but now the well-equipped and commodious terminals not only furnish canal accommodations but have added considerably to the efficiency of the whole port.

The New York Harbor Case has been called by one intimately connected with it a blessing in disguise. It was instituted by New Jersey on the plea that in justice she should have the benefit of the actual lesser rates to the railroad terminals within her borders rather than be charged the same rates as those for Manhattan and Brooklyn, which included lighterage costs in addition to rail charges. In its potentialities for undermining well nigh the whole commercial and industrial foundation on which New York city's greatness rested the case was one of the most important which the metropolis had ever been called upon to contest, and a reading of the current editorials of the city press reveals that the thinking men of the city so regarded it. But we need not now concern ourselves either with the details of the case or the history of port disputes which preceded it. In its decision the Interstate Commerce Commission declined to disturb the existing rate situation, but it counseled coöperation, and coöperation is just what has come out of the case and has made it a blessing in disguise. For years the inadequacy of the port had been apparent, but because the harbor was divided between two states, petty rivalry and jealousy and a short-sighted unwillingness to regard

the whole port as the single unit which by nature it was, had crowded out mutually helpful relationships.

The case was a blessing also in being the cause incidentally of a wide educational movement. While it was pending there resulted a large discussion of the problem of port organization. All the trades and civic bodies within the metropolitan district became vitally interested and the cities and commercial organizations along the Hudson were much concerned. The press of both New York and New Jersey gave the problems so much publicity that when the officials of the two States joined interests the people were ready to acquiesce and unite for the common good.

It may be that no adequate solution of the port problem could have been reached sooner. Doubtless it required an awakened New Jersey, a New York city with its transit question well past the initial stage, a New York State with its canal nearing completion, and an aroused spirit of liberality, which would break down political barriers and put aside jealousies, before the people of the metropolitan district were willing to make common sacrifice as well as common cause for a common future and could unite whole-heartedly in grappling with a common problem.

The united action was under the guidance of a bi-state commission, known as the New York, New Jersey Port and Harbor Development Commission, which consisted of three men from New York and three from New Jersey. The best expert talent in the land was employed and an exhaustive study was made of terminal conditions and operations in all its phases throughout the whole metropolitan district, now recognized as the Port of New York. Incidentally it is of some local interest to know that Barge canal engineers were loaned by State Engineer Williams to make the surveys of the proposed outer belt line railway to connect all the railroads entering New York city from the west.

Following this first commission there has been created a new body, given the rather clumsy title, Port of New York Authority, likewise composed of three men from New York and three from New Jersey. One of the New York members is Alfred E. Smith, former Governor of New York. Mr. Smith has recently contributed to a current periodical an article dealing with the port problem and what is being done to solve it, and so lucid and concise is his account that we shall let him tell the remainder of the story.

"After thorough investigation," says Mr. Smith, "the Bi-State Commission made final report to the Legislature of 1921, which recommended the creation of a port district to be defined by law and

to include one hundred and five organized municipalities, embracing a population of about 8,000,000 people. At present it is served by twelve trunk-line railways, which bring to or take out of or through the port over 75,000,000 tons of freight per annum. An immense number of foreign and domestic steamships, not less than 8,000, equally bring to or take out of the port over 45,000,000 additional tons of freight per annum. Within the port district there is more manufacturing output than in any similar area in the world, with a variety of products and commodities to be handled unparalleled anywhere else. Four million tons of foodstuffs alone are annually required by the people of the port district.

"The Bi-State Commission recommended a treaty between the two States calling for comprehensive development of the port which would effectuate a compact binding them, and establishing a port district and a Port of New York Authority over it. The Port Authority is composed of three members from New York and three members from New Jersey, and is a body corporate and politic. It is charged with the supervision and carrying out of comprehensive plans after they have received the approval of the Legislatures of both States.

"On August 23, 1921, President Harding approved the action of Congress ratifying the treaty and affixed his signature. There were appropriate ceremonies to mark so important an occasion.

"The Port Authority was directed by statute to study the plan of the Bi-State Commission, and any other plan that might be placed before it for consideration. This it did, working night and day during the summer and fall of 1921, and on January 1 of this year submitted to the Legislatures of both States a comprehensive plan.

"As an approach to the great task of preparing the plan, provision was made for the formation of an Advisory Council made up of representatives of chambers of commerce, boards of trade, and civic societies, of which there are one hundred and three within the port district. The several agencies engaged in transportation, such as the twelve trunk-line railways, the steamship companies, lighterage companies, warehouses and trucking interests, and various specialized industries, were all invited to organize co-operating committees in order that points of contact might be immediately established for the necessary conferences.

"Inasmuch as this whole problem is one that not only affects the business interests as far as the cost of business at the port is concerned, but also vitally affects the household and the cost of living, an Educational Council was organized to inform the public on the

subject and to lend its active assistance. In this Council individuals as well as representatives of all organizations within the port found membership.

"After long hours of conference with steamship companies, railway engineers, and terminal operators, all the facts set forth as to cost and method in the Bi-State Commission were substantially admitted and certain fundamental conditions were laid down as tending to provide a proper solution of the problem and to guide the Commission in setting forth the physical plans, and, so far as can be shown to be economically practical, the following definite fundamental principles were adopted:

"That terminal operations within the port district, so far as practicable, should be unified;

"That there should be consolidation of shipments at proper classification points, so as to eliminate duplication of effort, inefficient loading of equipment, and reduction in expenses;

"That there should be the most direct routing of all commodities, so as to avoid centers of congestion, conflicting currents, and long truck hauls;

"That terminal stations established under the comprehensive plan should be union stations, so far as practicable;

"That the process of co-ordinating facilities should so far as practicable adapt existing facilities as integral parts of the new system, so as to avoid needless destruction of existing capital investment and reduce so far as possible the requirements for new capital; and endeavor should be made to obtain the consent of the States and local municipalities within the port district for the co-ordination of their present and contemplated port and terminal facilities with the whole plan;

"That freight from all railroads must be brought to all parts of the port wherever practicable without cars breaking bulk, and this necessitates tunnel connection between New Jersey and Long Island, and tunnel or bridge connections between other parts of the port;

"That there should be urged upon the Federal authorities improvement of channels so as to give access for that type of water-borne commerce adapted to the various forms of development which the respective shore-fronts and adjacent lands of the port would best lend themselves to;

"Highways for motor-truck traffic should be laid out so as to permit the most efficient inter-relation between terminals, piers, and industrial establishments not equipped with railroad

sidings, and for the distribution of building materials and many other commodities which must be handled by trucks; these highways to connect with existing or projected bridges, tunnels, and ferries;

"Definite methods for prompt relief must be devised that can be applied for the better co-ordination and operation of existing facilities while larger and more comprehensive plans for future development are being carried out. . . .

"The inauguration of the Port Plan does not mean that the entire new plan is to be effective at once. . It does mean that it will be undertaken and extended as the needs of industry require. . . .

"To correct some false impressions, let me therefore say that under no conditions can the property of any municipality be touched for the improvement without its consent. Further, no public money is required to finance the project. The Port Authority is a body corporate and politic and must by the sale of bonds raise the necessary money to carry out its projects, and necessarily these must be self-sustaining in order that the interest and amortization payments on the bonds can be met from the profits of operation.

"The plan, among other things, recognizes the fundamental business principle that as much as possible of existing property and equipment already built and in operation should be used. Accordingly the plan takes full advantage of the great classification and break-up yards already built and in operation on the New Jersey side. The next step is to connect them with the New York side of the port. That is proposed to be done by a tunnel under the bay from the so-called Greenville Yards in New Jersey to a point in South Brooklyn where direct rail connection can be made with the New York Connecting Railroad, already built through Brooklyn, for transfer to the New England lines, with proper spurs along the water-front and to Jamaica Bay to meet the needs of that section. It also provides for proper spurs from the New York Connecting Railway to the Brooklyn water-front and into the Bronx, so that sections of the Bronx not adapted to residential purposes may be hereafter developed for industrial uses, enjoying the benefits of direct rail connection with the twelve great trunk lines of the country entering the Port of New York.

"The island of Manhattan presents the most difficult part of the problem.

"The Borough of Richmond is taken care of by the extension of the inner belt line in New Jersey down and across the Arthur Kill

by enlarging the existing bridge and widening the tracks of the Baltimore and Ohio Railroad.

"Aside from its physical aspect, the plan has for its purpose the unification of present terminal facilities. During the war, when the management of the railways was in the hands of the Government and they were used as an agency to win the war, they were compelled by Executive edict to unify their existing terminal facilities in the interest of speed and economy. Had it not been for such unification, it is extremely doubtful that the Port of New York would have been able to stand up under the pressure put upon it. As it was, congestion and delays incident to the old-time methods of doing business very materially added to the terminal costs.

"The argument has been made, and made without understanding of the subject, that there must be competition. That is not so. Competition in railway operation is the one competition that works against the public, and not for them, because it adds to the cost of the operation, and that is exactly what the Inter-State Commerce Commission had in its mind a short time ago when it declared for a policy of unifying the railways, so that there would not be more than sixteen or eighteen of them in the whole United States. . . .

"There is no disagreement anywhere on the facts set forth about the present condition. It has been recognized by even those who have not been in accord with the creation of the Port Authority or the development of the port by joint action between the States.

"The plan set forth for the development of the port is the result of intensive study on the part of the best engineers and terminal experts that could be gathered together in this country. Advising with them were the experts and engineers of the great trunk lines, the representatives of the great steamship companies, and traffic managers of great industrial plants, and it is entirely deserving of approval by the Legislatures of both States and without delay.

"Delay is dangerous if competition with our canal system and our port by the St. Lawrence Waterway is to be avoided. If the port is to stand in healthy competition with the other ports of the country, and if the people themselves in the great metropolitan district are to reap the full benefits and blessings that should flow to us from the greatest natural harbor in the world — a gift of Almighty God himself and fashioned with his own hands — the work should immediately be begun." *

* *The Outlook* for March 22, 1922.

CHAPTER XXXI

THE CANAL IN ITS RELATION TO OTHER WATERWAYS AND THE COUNTRY AT LARGE

Nation-Wide Influence of Erie Canal—Review of Early, Later and Present Influence—Testimony to This Influence—The Barge Canal a Connecting Link—The Intracoastal Chain on the East—Its History and Physical Features—Details of Its Present Status—Great Lakes and Connected Waterways on the West—A Rival Project, the St. Lawrence Ship Canal—Reasons for Desiring a Ship Canal—Its Strong Appeal—Contrast between the Rival Projects—Inception of Present Scheme—The Progress Made—Opposition Aroused—Recent Contest in Congress—Present Status—Public Debates by Two Governors—Claims by Advocates—Other Details—Arguments of Opponents—New York's Position—Study Showing Wide Influence of Barge Canal.

THE ERIE canal, in the broad field of its influence, has always been more a national than a state institution. From the day when President Madison, as one of his last official acts, vetoed a measure which would have given national assistance in the form of western lands—from that day till the present, down through the years of more than a century, in which New York has built and rebuilt and maintained its waterways, the chief branch of the system, the Erie canal, has brought quite as much of benefit to the country at large as to the State itself. After the President's veto the New York commissioner returned from Washington to Albany and recommended that the canal be undertaken by the State alone, remarking that "if the bounty of Congress had granted the entreated boon, it would have been merely the purchase, at less than its cost, of a most valuable object, by paying for it a tract of unsalable land."

It was on March 3, 1817, that the President had refused national aid. On November 4, 1825, eight years, eight months and one day later, there entered New York harbor from the north a fleet of vessels decked in gala attire, the first boats to traverse the length of the completed canal, and the city turned out en masse to welcome them and then joined in a celebration, the like of which had never been seen in the western hemisphere. New York alone and unaided had built a mighty canal, which stood before the world as the model for canal building for a half century and incidentally paid for itself

in less than twenty years. The part played by this canal in the development not only of New York state but of the whole territory in touch with the Great Lakes is well-known history and need not be repeated here.

"This canal," said a writer recently, "was the great western trunk-line of America for nearly forty years before any railroad system successfully competed with it. Not only did it provide cheap communication between the Great Lake states and the Atlantic seaboard, but it made possible the development of a large export grain trade. In this capacity it was supreme for another twenty years, but in 1869 the Pennsylvania and the New York Central railroads were completed to Chicago, followed in 1874 by the Baltimore and Ohio and the Grand Trunk. The freight wars which resulted reduced freight charges to a point which nearly bankrupted the railroads and incidentally cut heavily into the traffic of the Erie canal. The situation was adjusted about 1876, but rates never returned to their old level and canal traffic began to suffer. The State of New York endeavored to meet the situation in 1882 by abolishing tolls and further undertook progressive enlargement of the canal to permit the passage of larger boats, carrying heavier cargoes, but the export grain traffic via canal continued stationary or declining. This was due to several changes. Railroad rate-cutting had taken the grain from the canal and it did not return, but more important, perhaps, the territory that originally produced the grain for export was in Ohio, Indiana and Illinois, and as population grew there, the surplus grain fell off. Little by little the grain territory producing a surplus for export was pushed out into the Northwest, whence once loaded on cars, the grain went through without change. At the present time the surplus grain producing area has been pushed from Minnesota through the Dakotas and through the Canadian northwest, where it bids fair to remain. . . .

"The reconstruction of the Erie canal, as a Barge canal system, was stimulated in part by the desire to secure through the port of New York the export grain trade from the Great Lakes region, especially the Northwest, but in part also by the realization that industrial development in the northeastern states had reached a point where a trunk-line waterway system was again economically desirable. Transportation by modern barges between the Great Lakes and the seaboard is desired in many other lines than the grain trade. Coal, ore, building material, iron and miscellaneous freight of many kinds can pass between Lake ports and not only the port of New

York but all the north Atlantic seaboard territory. This assumes the completion by the Federal government on modern plans of the Atlantic trunk-line waterway, as originally sketched by Franklin and Washington. It enlarges the field of service of the New York system, the distribution of freight making it the connecting link between two great arteries of commerce — the Great Lakes and the thickly settled industrial and agricultural region between Boston and the North Carolina sounds. It is not alone as a State utility that the best returns on New York's great investment will be secured. This rather depends upon making New York, Buffalo and intermediate waterway points a central line for traffic gathered on the way from Buffalo to Duluth and in turn from Boston points, on Long Island Sound and the Connecticut river, from New Jersey points and on the Delaware river, Chesapeake bay and the North Carolina sounds.

"New York representatives in Congress have again a reason to urge Federal activity in waterway construction, not for the purpose of gaining allotments of public lands to pay for a canal built in New York, but for the purpose of urging completion by the Federal government of an improved system of Federal waterways, to take advantage of a great opportunity provided by their public spirited State and at a total cost to the Federal government much less than that willingly incurred by the citizens of New York." *

The strongest testimonies to the wide-reaching, beneficent influence of the Erie canal have come, not from its most ardent friends, but from those who have had no particular concern in its welfare and in some instances from those even who are counted among its enemies. The testimony from the latter class is most important, because it comes as an unwilling confession rather than as a voluntary tribute and has the binding force of evidence elicited under cross-examination.

The volume of this testimony from what we are terming extraneous sources is exceedingly large, but probably the strongest and the most convincing as well as the best known instance is the report of the Windom investigating committee, to which reference was made in our earlier pages and which declared that the Erie canal had done more to advance the wealth, population and enterprise of the western states than all other causes combined and that the only hope of the people against the combined influence of the power and

* Article by Wilfred H. Schoff, Secretary of the Atlantic Deeper Waterways Association.

capital of railroads lay in the Erie canal. Senator Windom himself in a speech on the Senate floor said that Erie canal rates exerted an influence over all other rates from the Gulf States to the St. Lawrence river and from the Atlantic ocean to the foot-hills of the Rockies. In connection with this investigation a railroad man, Albert Fink, doubtless the highest authority on transportation in the country at the time, said that the Erie canal regulated the rates not only on the railroads of New York state but on every trunk line connecting the Lakes with the Atlantic and also in the southern states generally, until it reached the line of influence of low ocean rates.

These words of recognition were spoken of the old Erie canal, but they may be equally true of the new canal, so its friends think, when adequate shipping shall have been provided. But the special purpose of referring to these opinions, which, emanating from persons who were not New Yorkers, were free from local bias, is to show the wide influence exerted by a canal that follows, as does the New York waterway, a certain favored route, the only feasible route in fact in the United States between the Great Lakes and the Atlantic ocean.

Of like import with the opinions just referred to is a speech made by one who had the opportunity by personal experience of knowing thoroughly the commerce of the United States. His sympathies, to be sure, were with New York, but his grasp of the subject and his business relations embraced the whole country. We quote a part of this speech.

"The highway across the state of New York," he said, "from the Atlantic to the Great Lakes and the Mississippi valley is the controlling factor over transportation in North America. Every other route from the base of the Rockies to the coast necessitates mountain climbing. Consequently the rate-making influence of the two New York Central lines and the Erie canal is paramount. Not only are rates to and from the east affected by this competition but the rates south to the Gulf and north to the St. Lawrence also come under its influence. This natural competitive influence is far more effective than the artificial restrictions imposed upon the railroads by the Interstate Commerce Commission for commercial policing purposes, and this is true in spite of the fact that one of the principal aims of these restrictions had been and is directed against the commerce of the Port of New York.

"It is surprising to what a comparatively slight extent this basic natural opportunity of the State has entered into the discussion of

its public affairs. The Empire State has never since the early days of the Erie canal availed of its opportunities as it should have done. Had it done so, its wealth and population would exceed present numbers." *

The office of the New York canal as a connecting link between the Lakes and the ocean is not the least of its good qualities. It has always been such a connecting link, of course, but now, because of the modern renaissance of waterways, it has become a link between two great systems of waterway improvements — improvements which in part have already been accomplished and in part are still only prospective. To some extent these systems are merely enlargements of earlier canals or revivals of former schemes, but never before have plans been so well laid or public sentiment so thoroughly organized for their fulfillment as now, and their fulfillment, moreover, as complete systems.

At the eastern end of the Barge canal lies the system of intra-coastal canals reaching from Maine to Florida and thence to the Gulf of Mexico. It was to promote this scheme in all its several parts that the Atlantic Deeper Waterways Association came into being about a decade and a half ago and it is the consummation of this scheme in its entirety, a condition which is essential to its full usefulness, that the Association, aided by a host of interested supporters, is striving zealously to attain.

This is no new scheme. It dates back to colonial times. A great stimulus to canal-building came in America in the days when there were few improved roads in the colonies and railroads were as yet unknown. The small canal was a much more efficient carrier of freight than any road built after the fashion of the time, and as the settlements were principally east of the Alleghanies a water trunk-line along the Atlantic coast was looked upon by many as the best solution of the transportation problem. The advantages of this scheme were pointed out as early as 1769, when Benjamin Franklin and others submitted to The American Philosophical Society in Philadelphia a plan for the construction of connecting ship canals between the various bays and sounds, substantially along the route now agitated by the present Association. Subsequently the movement was strongly encouraged by George Washington, who went much farther and sketched out a plan for connecting the coastal waterways with the Great Lakes and the Ohio river. Also every

* Calvin Tomkins, Commissioner of Docks, New York city; paper read at convention of New York State Waterways Association, November 2, 1911.

American President from Washington to Jackson featured canal-building and river improvement as important items in the economical development of the country. But the nation was poor and canal-building on a large scale was beyond Federal resources. Moreover State jealousies were still strong and there was a disposition in Congress to discourage enterprises that would develop one state faster than the others. Under Washington and his immediate successors the Federal government joined in organizing corporations to construct the Chesapeake and Delaware, the Chesapeake and Ohio and the Dismal Swamp canals and purchased large blocks of stock of those corporations, but progress along the whole extent of the coastal project has been but gradual and very slow.

The many bays and sounds and peninsulas and islands along nearly the whole extent of the Atlantic coast form well-nigh ideal conditions for intracoastal canals, making possible an almost continuous system with a minimum of construction. Moreover this chain of protected coastal waterways has many potential benefits, commercial, military and naval, to bestow upon the nation, but of this it is not necessary now to speak. The essential need of a link to connect this system with the great inland seas and their adjoining waterways does, however, concern us. The present plans for the intra-coastal canals call for modern and, for the most part, deep channels. The link that connects the system with the Great Lakes, the New York Barge canal, but just now enlarged and thoroughly modernized, occupies the most strategic canal location in the whole country. Aside from its importance in its own right it is almost equally important as a link to join two great systems which together and by means of this connecting link establish a vast system of inland waterways that penetrates to nearly all parts of the eastern half of the country.

Our principal study of course concerns the Barge canal, but it is very important to know what part the New York canal plays in the broad waterway scheme of the whole country, and so it is pertinent to include here an account of the present status of the intra-coastal projects.

The Boston-Beaufort section, according to present War Department recommendations, has a minimum depth of 12 feet. From Boston to Sandwich, through Boston harbor and Massachusetts and Cape Cod bays, there is natural open water navigation. From Sandwich to Buzzards bay there runs the Cape Cod canal, 8 miles long with 25 feet depth at low water, built by a private corporation

but authorized for Federal acquisition by the 1917 River and Harbor Act, with a report as to price now before Congress. From Buzzards bay to New York, through Buzzards bay, Block Island sound and Long Island sound, there is open water. At New York the further improvement of East river, Bronx kills, Harlem river and Spuyten Duyvil creek has been recommended by the War Department and in part authorized by Congress.

From New York to Raritan bay, through Kill von Kull, Arthur kill and Staten Island sound, further improvement has been recommended by the War Department and in part authorized by Congress. From Raritan bay to Delaware river, through the New Jersey intra-coastal canal, 33.7 miles long, construction has been recommended by the War Department and the right of way pledged by the State of New Jersey. Between Bordentown and Philadelphia, through the Delaware river, a 12-foot Federal channel has been completed from Trenton to Philadelphia.

Between Philadelphia and Delaware City, through the Delaware river, a 35-foot Federal channel is under construction from Philadelphia to the sea. Between Delaware City and Chesapeake City the Chesapeake and Delaware canal, 13.7 miles long, was purchased by the Federal government in 1919 and has been operated as a toll-free waterway. The War Department has recommended improving the canal by removing the locks and bringing it to a tide level with 12 feet depth. From Chesapeake City to Norfolk, through Elk river, Chesapeake bay and Hampton Roads, there is open water.

From Norfolk to Albemarle sound navigation is by means of a Federal inland waterway which has been provided by the purchase of the Chesapeake and Albemarle canal by the Government and its conversion into a tide-level waterway of 12 feet depth. From Albemarle sound to Pamlico sound there is navigation in a Federal inland waterway by a present route via Croatan sound, but a project for improvement via Alligator and Pungo rivers has been recommended by the War Department and adopted by Congress and work is under way. From Pamlico sound to Beaufort inlet, N. C., through a Federal inland waterway, the improvement via Neuse river and Beaufort cut has been substantially completed.

The Beaufort-St. Johns river section, according to present War Department recommendations, has a minimum depth of seven feet. From Beaufort inlet to Cape Fear river and from Cape Fear river to Winyah bay, S. C., outside routes are now used and the Federal inland waterway recommended by the War Department follows

largely existing sounds and thoroughfares. From Winyah bay to Charleston, S. C., the Federal inland waterway recommended by the War Department is to be secured mainly by deepening existing channels along an inside route now available but of limited depth. From Charleston to Savannah river an inside route of six feet depth at low water now available has been recommended by the War Department for Federal improvement to the standard depth. From Savannah river to St. Johns river, Florida, an inside route of seven feet depth at low water now available has been recommended for Federal improvement mainly by widening at narrow points.

If this intracoastal chain of waterways were all improved, it would afford a continuous navigation of about 1,800 miles.

At the western end of the Barge canal lie the great inland lakes with their natural navigation of about 1,500 miles. But these lakes do not constitute the whole of the waterway system, existing or contemplated, of the Middle West. Numerous canal schemes have been agitated since the Barge canal was begun and some of them have passed from the stage of agitation into that of preliminary surveys. Of these there are four in the region of the Great Lakes which are worthy of notice. If built, they will be in effect extensions of New York's Barge canal and their efficiency will depend in large measure upon the Barge canal, since it forms the outlet between them and the sea. These four proposed canals are, first, the Lake Erie and Ohio River canal, which would join the Ohio river at Pittsburg with Lake Erie, and for which complete surveys and estimates have been made by the States of Ohio and Pennsylvania; second, the Lake Erie and Lake Michigan canal, surveyed by the United States engineers and joining the heads of Lakes Erie and Michigan by a line only one-third the length of the present natural route, thus bringing Chicago, Milwaukee and Grand Rapids that much nearer to the eastern states and the ocean; third, the proposed improvement of existing canals in Illinois, which extend between Lake Michigan and the Mississippi river; fourth, a canal from the head of Lake Superior to the cities of Minneapolis and St. Paul.

For all of these projects the Barge canal furnished standards upon which to base both dimensions and plans. The engineers who were about to undertake the surveys visited the New York canal before beginning their work. In some cases also the services of Barge canal engineers were secured to assist in planning the proposed waterways. Of the four projects mentioned, little has been heard

recently concerning the Lake Erie and Lake Michigan scheme or the canal from Lake Superior to Minneapolis and St. Paul. The Ohio River and Lake Erie project, however, is still a live issue and, because of the importance of the region to be served and the great volume of prospective traffic, it seems probable that eventually this canal will be built. Illinois is now improving its canals and there are indications that these improvements may be rather extensive before they are all finished.

Thus it appears that both the existing and prospective mileage of waterways connected by the Barge canal and also the extent of territory influenced by its building are very great. Even now the 1,500 miles in the Great Lakes and the 800 miles of New York waterways form a mighty system. If, however, all or even part of the canals and improvements adjacent to the Great Lakes and also the Atlantic intracoastal chain with its navigation of 1,800 miles are eventually built, the area coming under the influence of the Barge canal will indeed be vast.

Since Nature's most favorable route for a canal between the interior and the coast lies in New York, the State in serving itself of necessity, as we have seen, had to serve others. While it is probably true that the primary purpose in its canal-building has been to serve itself, still it cannot be said with truth that New York has been entirely selfish. Rather the opposite is true. Doubtless, however, the State should not have been compelled single-handed to build and maintain for a century and more the waterway which has regulated the freight rates for half of the country and which has been the only means of combating the large outlays made for the avowed object of diverting the traffic of the interior from American to Canadian channels, but to those who are familiar with the circumstances New York's generous purpose has seemed genuine. In spite of this action, however, rival canals have been agitated and the latest of these, the proposed St. Lawrence ship canal, threatens the success of the Barge canal to the extent at least of so diverting attention as to make it difficult for the New York canal to prove its value.

Soon after the Barge canal was begun there was a movement on foot for a fourteen-foot channel up the Mississippi and on to the Great Lakes. This was known as the Lakes-to-Gulf project and it was sponsored by the Mississippi River Improvement Association. The scheme received a severe blow in June, 1909, when the board of Government engineers, having investigated the section from St. Louis to the Gulf, reported to Congress that such a waterway was



Entrance into eastern end of Oneida lake. Concrete breakwater piers, extending about 1,600 feet into the lake, protect the channel. The shifting sands of this region have added greatly to the problems of construction and maintenance. The sailing course westerly is straight for nearly 14 miles, lying on a line between the Sylvan Beach and Frenchman's island lighthouses. At the breakwater ends appear the cabinets which carry smaller lights.

not desirable. These engineers estimated the cost of constructing the portion they investigated at \$128,000,000 and the annual maintenance charge at \$6,000,000. One reason for the failure of this project was the fact that, although it promised to benefit commerce between the Lakes region and the southern hemisphere, it had nothing to offer in the way of better traffic relations with European ports. This fact is most strikingly illustrated when one considers what would happen to a shipment starting from the head of Lake Superior and going to Liverpool by way of the Mississippi. After it had gone 2,000 miles and reached the mouth of the river, it would still be 4,500 miles from its destination, no nearer than at the beginning of its journey.

After the adverse Federal report this Mississippi project lay quiescent and the association became inactive till the St. Lawrence scheme was conceived. Then the organization served as a nucleus about which to build the new movement.

In discussing the St. Lawrence ship canal project, which contemplates a channel of sufficient size to enable ocean-going vessels to penetrate to the Great Lakes, we must remember that an intense controversy has arisen over the matter and that the two sides of the question have little in common; in fact they are almost diametrically opposed. Moreover the subject is rather complex, but stripped of its minor features it resolves itself primarily into the question of ship *versus* barge canals. It is not, however, a simple question of ship or barge canals; it involves the problem of a ship canal to reach points ranging from a thousand to twenty-five hundred miles inland. Territorially the contest is between nearly a score of states, mostly Middle Western, and the rest of the country, particularly New York, since she, because of her own waterway, is the chief exponent of the barge canal principle, and also since her metropolis would suffer most if any considerable amount of commerce were diverted to the proposed Canadian route.

To understand the enthusiasm the St. Lawrence scheme has evoked we must realize that the Middle West very acutely feels the lack of adequate transportation; also that, through a just pride in the remarkable growth of the region and a feeling that it is too important longer to tolerate inadequacy, these states absolutely refuse to brook further restraint. Moreover in the scramble for world trade the Lakes region evidently appreciates in full measure its serious handicap of remoteness from the coast and is trying to overcome the disadvantage.

This attempt to carry the coast inland is a subject of supreme importance to the whole country as well as to the Middle West. Let us consider one particular phase of it briefly. The marine commercial development of a country is not solely a matter of bringing ships to its ports and carrying away the products found close to its shores. It is the heart of the country, the vast inland stretches, that must be depended on largely to fill the holds of ships and make their operation possible. In the United States the shape of the country presents a grave difficulty in reaching its heart. We are confronted by a solid block of land, 3,000 miles across from ocean to ocean in a longitudinal direction and 1,600 miles from north to south, without a single salt-water bay or indentation reaching a hundred miles directly inland. In all this vast area, moreover, there are but three navigable slits, the Mississippi, the Hudson and the Columbia rivers, and of these the Hudson and its artificial connecting links form the only watercourse running east and west, the direction most desirable for an outlet to the world's marts. In contrast the countries of Europe, our chief rivals in trade, are lavishly supplied with penetrant arms of the sea. The continent is one fretwork of bays and indentations. Every nation except Russia is thoroughly marine, since the heart of none is more than three hundred miles from salt water. And to supplement their natural advantages the most elaborate systems of artificial waterways and improvements in the world are found there.

This is no new situation; it is as old as the continents and the waters themselves; but it explains several things nevertheless, and the realization of the fact has become more acute of late because of changing conditions at home and abroad in industrial and commercial affairs. A review of the situation, moreover, helps to clarify our understanding of the reason why the ship canal idea is so popular and so persistent and why it is so necessary that a territory two thousand miles inland should have cheap water transportation. We learn from this review also why New York built her canal, but her conclusions and her method of procedure differed widely from those of her sister states.

Looking at this situation from the standpoint of the whole nation we know that, although lacking natural indentations of the sea, we must in effect extend our littoral many miles inland. This is absolutely essential. We must compete for the foreign trade. For the sake even of our home trade we must do this. Otherwise we shall relapse into a hermit nation and history tells us that such a condition would be fatal.

There are many evidences that the Middle West never relinquished the idea of eventually having a ship canal from the ocean to the Lakes. And to be sure it is pleasant fancy, not easily given up, and one to tickle the imagination; there is a fascinating glamour enveloping the thought of giant ocean ships sailing to the heart of the continent and there exchanging the products which they have brought from the uttermost parts of the earth for the grain, the lumber and the ore of the vast Northwest. The advocates of the St. Lawrence project have used to the full the magnificent appeal in this idea. They have played upon the almost universal human tendency to prefer the spectacular to the commonplace and have taken advantage of the natural trait, at least the American trait, to regard the biggest of its kind as necessarily the best.

The St. Lawrence promoters affect to despise the Barge canal. Doubtless they would consider it presumptuous to make comparisons between the two projects, especially to the disparagement of the ship canal scheme, but so pronounced is the contrast between them that one who has studied the history of each enterprise cannot fail to be forcibly struck by it. This contrast may be presented in the form of two pictures, one in retrospect, one now in full view, and our description, we think, is not overdrawn.

On the one hand we see New York deliberately and dispassionately considering the problem of building a canal from ocean to Lakes, appointing a commission of unbiased and level-headed business men and capable engineers to evolve the best plan, and then, after careful surveys and full discussion, proceeding resolutely to carry out that plan and moreover to bear alone the whole expense despite the fact that the cost would be enormous and the further fact that others would enjoy the benefits of the enterprise quite as much as would the State itself.

In the other picture we see a score of states wildly enthusiastic over a project that has not the support of scientific investigation to test its practicability or even of accurate surveys to determine its cost. We see these states complaisantly adding a stupendous water-power scheme to the original project in order to gain the help of states not interested in the canal alone. We see them calmly ignoring the fact that the proposed canal if built would be almost useless without the expenditure of a vast sum for deepening lake harbors. Also we see them even depending on the overwhelming power of a project backed by national approval to convince a lukewarm or, it may be, a reluctant sister nation of the advantages of coöperation.

Then we see them marching upon Congress and demanding not an unbiased investigation and a thorough survey but an immediate undertaking of the work, the United States to join with Canada in paying for the cost, thereby letting the interested states go free, although the total United States expense according to their estimates is only about three-quarters of the amount New York alone paid for its new canal. Finally we see these states endeavoring to push this measure through Congress willy-nilly in spite of grave doubts in the minds of all save the advocates themselves that ocean shipping can ever be induced to penetrate to the Lakes and in the face of protests demanding that, before so monstrous and so far-reaching a policy shall be adopted, precisely what is being undertaken must be known and its cost determined beyond reasonable question.

Although there had evidently been slumbering in the minds of middle westerners for a considerable time the idea that some day there would be a ship canal from ocean to Lakes, the genesis of the present movement may be traced to a certain public meeting and to a particular individual. But the proposition, put thus in concrete form, became popular at once and its advocacy spread rapidly. Whole states were enlisted in the cause and their legislatures appropriated funds for its furtherance. After most of the central section of the country had been brought into line the advocates launched out into wider territory. It was to gain New England that the water-power idea was added. In brief the scheme is to provide a 25-foot or possibly a 30-foot channel for ocean vessels and to develop the power incidentally created in canal construction. The length of new channel work needed to carry out this plan is comparatively short, only a few miles, but nearly all such places lie in Canadian territory and also the length of the St. Lawrence river from ocean to Lake Ontario is nearly twelve hundred miles. Moreover by far the greater part of the river flows through Canada, only about a hundred miles at its upper end being a national boundary stream.

National public attention was first focused on the St. Lawrence project when a clause in the Rivers and Harbors bill of the 65th Congress authorized a joint investigation by the United States and Canada. Immediately after the introduction of this measure and before final action could be taken bitter opposition arose, but the ship canal forces were too strong to be defeated in the time then available and all that the opponents could do at that juncture was to have an amendment added for an all-American route, authorizing a survey for a ship canal between the Great Lakes and the Hudson

river. The investigation was to determine "what further improvement of the St. Lawrence River . . . is necessary to make the same navigable for ocean-going vessels." The investigators were ordered also to make recommendations concerning coöperation by the United States with Canada for the improvement.

In accordance with this Congressional mandate the investigation was duly made. The opponents of the project, however, consider that they were not given equal opportunity with their rivals to present their side of the case. The report of the International Joint Commission favored the proposed canal but counseled further and complete investigation. Thereupon, however, a bill was introduced in Congress to take steps immediately for its construction.

But meantime a considerable portion of the country had been aroused to deep interest in the proposition. The advocates had been well supplied with money from the beginning and all through their campaign by means of continuous publicity and agitation they have been tireless in their efforts to gain and keep adherents. The opponents on the other hand have had very little money to spend and have not been so well organized. Still they have been able to reach a large portion of the public through the newspapers. At the suggestion of the Superintendent of Public Works the New York Legislature created a commission to care for the State's interests and Governor Smith appointed as members of this body, Senator L. W. H. Gibbs, chairman, Senator James J. Walker, Assemblymen S. L. Adler and Charles D. Donohue, State Engineer Williams, Superintendent of Public Works Walsh, Murray Hulbert, Commissioner of Docks of New York city, and Henry W. Hill, President of the State Waterways Association. These commissioners appeared at the hearings of the International Joint Commission. Also at other times and in other places they have endeavored to spread abroad information to confute what New York regards as the chimerical and perilous doctrine of a ship canal to the Great Lakes. A valiant champion of the State's cause appeared in the person of Governor Nathan L. Miller. Soon after assuming office Governor Miller showed a deep concern in the affair and through his public utterances he has been able to accomplish more probably than any one else in whatever success the opposition has achieved.

One of the means employed to spread information was an excursion over the Barge canal during the fall of 1921. We have mentioned this event earlier in the volume. It was planned by various

commercial bodies and interested individuals of the state and the company taken on the trip comprised Congressmen, shippers and others from a rather wide territory, including the Middle West, the South and the Southwest. Apparently the effort was successful; the visitors seemed to be converted to the barge canal idea. They acknowledged that their previous conception of the New York waterway was that it still was the shallow, old-fashioned canal of the past.

After the bill for the St. Lawrence canal was introduced in Congress counter moves immediately were made. One was for a ship canal all in New York state, to be built by a private corporation. This was not a new scheme; it had been presented to the Federal Power Commission in January, 1921; it was a plan advanced by Millard F. Bowen, of Buffalo, who proposed to form a corporation to be known as the Great Lakes to Hudson Ship Canal Company, which would build and operate at its own expense a toll-free ship canal of 30 feet depth, traversing New York territory but utilizing Lake Ontario from Olcott to a little east of Oswego, on condition that it receive the income from the water-power to be created and from terminal charges and a few other incidental sources.

Another counter measure was a bill introduced by Representative Ten Eyck of Albany, proposing that Great Britain cede to the United States all Canadian territory south of St. Lawrence river and St. Lawrence bay, the value of this land to be deducted from the war indebtedness owed to the United States by Great Britain. This measure of course could scarcely be taken in earnest except as it showed the justice of the claim that the United States, if it were to pay its share of the proposed St. Lawrence canal, should own all of the land on one side of the channel and thereby be able to have equal rights with Canada. A somewhat similar but more moderate proposition was contained in a resolution introduced by a senator from Utah. This measure called for the cession to the United States of Canadian territory south of the St. Lawrence and west of the Richelieu rivers.

The St. Lawrence measure seems to have been blocked for the present. In consideration for items in the Rivers and Harbors bill for various local improvements sufficient support was arrayed against the canal project to prevent its passage. This action, however, cannot be charged to New York's account; the State has waged only a fair and open fight. President Harding's action has also postponed

further legislative progress for a time at least. The President has declared himself in favor of the canal, but he has taken the stand that before anything else is done treaties preliminary to its accomplishment must be made with Canada and Great Britain. He directed Secretary of State Hughes to begin negotiations for such treaties. Canada has in effect declined to enter into such a treaty.

Two events to attract wide-spread national interest since the St. Lawrence bill was introduced were debates on the measure by Governor Miller of New York and Governor Allen of Kansas. These took place, one at the annual convention of the National Rivers and Harbor Congress, held in Washington, and the other at Chicago. The prominence of the debaters as well as the importance of the subject gave the affairs much publicity.

It is not necessary to say much more concerning the St. Lawrence project. The subject is both too large and too complex to treat exhaustively without giving it more than suitable space. There have been arguments almost without end on both sides. Moreover it cannot be denied that there have been foolish things said on both sides. A believer in the Barge canal, however, can see little excellence or reason in the claims of the advocates, while he can see much to criticise and condemn.

The desperate need of the Middle West for better transportation is conceded by everybody, but that need constitutes no argument to prove that the proposed canal will satisfy it. And yet such plea, reiterated ad infinitum, has been the chief argument in its behalf. One gross overstatement along this line was brought out in one of the debates between Governors Miller and Allen. In refutation of a total tonnage of 200,000,000 tons estimated to be available for export from the Great Lakes region and vicinity it was shown that only 54,000,000 tons were exported annually by the whole country. The other principal argument is the claim that the cities on the Lakes will become seaports. This premise of course is fundamental; on it stands or falls the whole project. The opponents consider that the claim that ocean vessels will penetrate the continent for the hundreds and even thousands of miles necessary to reach these inland ports is absolutely and undeniably without authoritative support and also contrary to all probability. It was the careful investigation by a Federal engineer that first showed the relative economy of a barge canal to the Great Lakes and it was this investigation which brought to naught the United States Deep Waterway plans for a ship canal and which also induced New York to select the barge size for its new

waterway. So far as we are aware no other competent investigation has ever been made on this subject and nothing has occurred to disprove the conclusions of the one careful study.

But it is not our province to debate the question. Briefly, however, we may mention a few more incidents. Early in the agitation State Engineer Williams said that if there really must be a ship canal, although in his opinion it was not necessary, the logical course for it was the Oswego-Oneida-Mohawk route, substantially that of the Oswego and eastern Erie branches of the Barge canal. Recently Superintendent of Public Works Cadle has voiced much the same proposal. Also a prominent Canadian engineer has given it as his opinion that the best solution of the problem is a channel for ocean vessels up the Hudson and a meeting between ocean and lake boats in the vicinity of Albany or Troy. This is almost precisely the idea advocated by certain New Yorkers — a combination of the Deeper Hudson and Barge canal projects. Whether under this scheme the Barge canal is of sufficient size to meet all the needs is as yet undetermined. There have been some attempts to develop a type of boat suitable for both Great Lakes and Barge canal navigation, but entire success has not crowned the venture and also there is question whether such a thing can be done successfully. If, however, it should be necessary to enlarge the Barge canal between Troy and Oswego, the cost would be small in comparison with the St. Lawrence ship canal. It will be recalled that State Engineer Bensel in 1912 recommended a widening of the narrow portions of this stretch so as to allow two of the larger lake boats to pass one another.

This view of the Canadian engineer reveals a condition which the advocates have ignored. Canada is by no means entirely convinced of the desirability of a joint project. Moreover in all probability a new treaty would seek to readjust the allotment of Niagara waters, and Canada will be very slow to relinquish her present share, which is almost twice that allowed the United States. Also there are evidences of desertion even from the ranks of the Middle West. The city of Cleveland recently received an adverse report from a committee it appointed to make a careful investigation of the whole subject. The general discussion and the wide publicity the topic has evoked since it came before Congress are evidently showing results. And this publicity by the way should redound to the benefit of the Barge canal by advertising its importance and usefulness. A strong name lately to appear among the list of St. Lawrence opponents is

that of General Goethals, the builder of the Panama canal. His opposition was based on the ground of the impracticability of a ship canal to meet the particular need.

Very briefly we shall marshal a few facts which the opponents of the ship canal project have brought forward. In the first place they declare that ocean-going ships, because of their heavier construction and higher cost to build and operate, their method of loading through small hatches and their comparatively slow speed in restricted channels, can never be induced to make such a long trip inland and moreover if they could be induced to give the plan a trial the smaller boats would so outstrip them in economy that further trips would be abandoned. Also the possibility of bringing in and taking out full cargoes without stopping to gather them at several ports would be remote. The absence of accurate data on which to base an estimate of cost is a grave defect. The figures given by the rival contestants are wide apart. The fact, which by the way cannot be denied, that the lake harbors are not deep enough for ocean ships and would have to be improved at a vast added expense, has been a most serious handicap to the success of the scheme. Then too the difficulties of international control, the shorter navigation season and more perilous channel of the northern route, the inability of Montreal to absorb as well as to furnish full cargoes, if ocean ships should not pass beyond that city, these are all objections hard to answer. The necessity for duplicating port facilities to care for ocean traffic during the months when the ship canal would be closed is a great drawback to the acceptance of the plan. Moreover the joining of the canal and the power projects has been a subject of severe criticism. It is said that certain New England power companies are deeply interested because of the probability of gaining substantial profits from the venture. This fact, when known, has not added to the zeal of the people on either side of the border in the vicinity of the prospective power sites.

We spoke of New York being opposed to the St. Lawrence project because she believes in the barge canal theory and because her commerce might suffer from a diversion of traffic, but there are other as weighty reasons. Assuming that the proposed ship canal were built and ocean ships were regularly plying upon it, then probably New York would lose much of her commerce and with it much of her prestige. But if such change should benefit a large section of the land, New York could not well complain. The State, however,

does not believe that ocean shipping would use the canal if built and therefore objects to such a large and useless expenditure, especially as she would be called upon to bear a great part of the cost. What is more likely to happen is this: Ocean vessels would stop at Montreal and lake freighters would meet them there. Not only would this divert commerce from New York, but it would take it entirely out of the country. Such an outcome is most undesirable, New Yorkers think, in view of the possibility of securing equal or better facilities wholly within our own borders and at much less expense. But New York's share of the cost is perhaps the most serious consideration. Because of her wealth and her large population the State pays nearly a third of all Federal expenditures. But of greater import, New York owns the power rights on the American side of the St. Lawrence. If the canalization scheme should be accomplished, the United States would take over these rights as a part of the requirements for navigation and the State would lose a most valuable asset. If it should happen, as the enthusiasts declare, that the returns from power development will repay the whole cost, then New York would find herself in the position of paying the entire United States share by means of the water-powers now owned by her but taken away under guise of navigation requirements. If, as the advocates say, these powers can finance the whole project, then their potential value to the State must now be equal to the enormous cost of the enterprise.

In a word this is New York's position: After having spent her hundreds of millions through a century to build and maintain a canal and then well towards two hundred millions more to rebuild it in such manner as in her opinion to enable it to relieve the traffic congestion from the west or at least to go a long way towards that end — after having done all this, knowing full well that all through the century the states to the west have shared and for the future may continue to share the benefits equally with herself, New York is confronted with the prospect of being compelled against her will to pay nearly a third and perhaps the whole of the cost of a rival canal, and meanwhile to lose priceless water-power rights, although she firmly believes that the expected ocean vessels will not use such canal, that the money will virtually be wasted and that the canal will accomplish little if any more than her own waterway except to divert traffic to a foreign route. What wonder then that New Yorkers are fighting the St. Lawrence project or that they seem determined to continue their battle to the bitter end!

Just one more instance of the wide influence of the Barge canal before we finish. This was brought out in a study made during construction. One result of the opening of the Panama canal was to bring pointedly to the minds of shippers the difference in rates between rail and water-borne transportation. In the lumber trade this difference was seen very clearly. The forests of the East have become so nearly exhausted that for some time the East has had to draw much of its supply from the Pacific coast states. As soon as the Panama canal was opened this traffic began to turn, western lumber coming by boat to Atlantic or Gulf ports and then being reshipped by water or rail to the interior of the whole eastern half of the country. And this came about because the saving in cost was a considerable sum on every thousand feet. A study as to how the Barge canal would extend the limits to which Pacific coast lumber might profitably be shipped by the water route brought out some interesting facts. Two routes were considered, one overland from the Pacific coast by rail and the other by water east through the Panama canal, then back west through the Barge canal and the Great Lakes and continuing west by rail. If we assume that the lumber which has come by boat from the Pacific coast to New York city continues to move by water, reversing its general course and going back west through the Barge canal and on through the Great Lakes as far as they extend, and then if we compare the cost of transportation by this route with the cost to ship the same lumber overland by rail to the same points at the western extremities of the Lakes, we find a balance in favor of the water route, although the distance traveled is several times that by land. Now, if we spend this balance to move this water-borne cargo still farther to the west, using railroads of course, we shall reach a point where the cost of transporting this cargo will exactly equal the cost of the cargo coming overland by rail. Drawing a line through several points obtained in like manner, we shall obtain a boundary which we may call the "line of equal costs." The interesting fact about this line is that it is away to the west of the Mississippi river, scores and in some cases hundreds of miles. The area thus benefited by the Barge canal includes most of the northeastern quarter of the United States, embracing the territory east of this line of equal costs and north of the Ohio river. This area would extend farther south were it not for the fact that the cargo approaches the country from the south and so the Mississippi river and southern railroads from the coast become competing factors.

Experience since the new canal has been in operation has shown that not only lumber but other products of the Pacific coast as well are being shipped to advantage by the all-water route, the combination made possible by the Panama and Barge canals. This is simply one of the many instances which go to show the truth of the statement made at the beginning of this chapter, that the Erie canal in the broad field of its influence has always been more a national than a state institution. The friends of the new Erie, what we have come to call the Barge canal, predict for it as glorious and as useful a service as ever the old Erie had. This end has not yet been attained, but it is possible. It means, however, unflagging zeal and tireless work—in building up an adequate fleet and making the public canal-minded.

CHAPTER XXXII

TABLES OF CONTRACTS

Construction of Barge Canal: Erie, Champlain and Oswego Canals, Work Completed and Work under Contract; Cayuga and Seneca Canal, Work Completed—Construction of Barge Canal Terminals: Work Completed and Work under Contract.

IN ORDER not to burden the text of the present volume with too great detail, the contracts under which the Barge canal and terminal construction work was performed have been listed in tabular form and are here inserted under a special chapter heading. From these tables it may be learned when the work at the various localities was undertaken and also what the cost was. There are summaries which give the total costs. It should be said that all these figures represent the cost of construction and do not include the engineering, the purchase of land, awards for damages and interference with vested rights, and other incidental expenditures. The tables show that virtually all canal construction is completed, while on terminal construction, especially the installation of machinery, considerable is still under contract. The logical arrangement in the tables has seemed to be that of contract number, but since no very definite or easily-explainable system was employed in the original assignment of numbers, search for any given piece of work will have to be made until it is found.

It will be seen that the total construction cost of the Erie, Champlain and Oswego branches of the Barge canal, as shown in the following tables, is \$96,685,570. In 1903 it was estimated that this cost would be approximately \$84,000,000, but in 1915 it was evident that this amount would be exceeded, and the reasons therefor are given on pages 246-9 of this volume. Since that time there have been some other extraordinary increases in cost of labor and material, brought about by World war conditions, which tended very materially to increase the total cost of the construction work above either the 1903 or the 1915 estimates.

CONSTRUCTION OF THE BARGE CANAL
WORK COMPLETED ON THE ERIE, CHAMPLAIN AND OSWEGO CANALS UP TO OCTOBER 18, 1922,* EXCLUSIVE
OF THAT DONE UNDER CHAPTER 585, LAWS OF 1918

Contract No.	Canal	Description of work	Contractor	Date of contract	Total construction cost, including alterations and extra work orders
1	Champlain.	Northumberland to Fort Miller, and Crockers Reef to Port Edward.	Empire Engineering Corporation.	4/18/05	\$479,875
2	Erie.	Locks 2 and 3 and prism through Watford.	The Ferguson Contracting Co.	4/ 3/05	725,930
2-E	Erie.	Completion of Contract 2.	Holler & Shepard.	12/ 8/09	286,135
2-G	Erie.	Tamoor gate, etc., Watford side-cut.	A. A. Parker.	10/17/16	11,590
3	Champlain.	Lock 6 and land line, Fort Miller to Crockers Reef.	Sundstrom & Stratton.	4/ 4/05	688,129
4	Erie.	4 1/2 miles east of Oneida lake.	Empire Engineering Corporation.	4/18/05	732,057
4-B	Erie.	Bridge on Burdick's road adjacent to Contract 4.	E. J. Doyle & Co.	12/ 1/10	1,332
5	Erie.	Mosquito Point to Fox Ridge.	Empire Engineering Corporation.	4/18/05	125,820
5-A	Erie.	Completion of Contract 5.	James Stewart & Co.	1/20/12	319,351
6	Erie.	N. Y. C. R. R. west of Rochester to South Greece.	F. A. Maselli.	5/ 3/05	1,034,630
7	Erie and Champlain.	Superstructure of highway bridges, Contracts 2, 3, 4, 5 and 6.	The Groton Bridge Co.	8/10/06	103,173
8	Erie.	Locks and dams at Scotia, Rotterdam and Craneyville.	Pittsburgh-Eastern Co.	5/22/06	920,776
8-A	Erie.	Completion of lock and dam at Scotia.	The Foundation Co.	7/ 6/12	967,610
9	Erie.	Eagle Harbor to Medina.	Thomas Crimmins Contracting Co.	3/18/08	659,955
10	Oswego.	Locks and prism at Fulton.	Mc Dermott Contracting Co.	6/ 7/06	670,379
10-A	Oswego.	Completion of portion of Contract 10.	The T. A. Gillespie Co.	12/14/11	168,583
10-B	Oswego.	Completion of portion of Contract 10.	Oswego Construction Co. Inc.	3/ 4/12	533,811
10-C	Oswego.	Filling portion of old canal at Fulton.	Pulton Engineering Co. Inc.	11/18/14	39,904
11	Erie.	Locks 4, 5 and 6, guard-gate and prism, Watford to Crescent.	Port Orange Construction Co.	5/21/06	1,221,322
12	Erie.	Dredging, Oneida lake to Mosquito Point; Lock 23.	James Stewart & Co.	9/23/07	3,105,781
13	Erie.	Superstructures of highway bridges, Contract 18 and part of Contract 12.	Penn Bridge Co.	11/ 7/08	23,412
14	Erie.	Crescent to Rexford Flats; Mohawk river locks and dams.	Acme Engineering & Contracting Co.	9/10/07	2,676,042
14-A	Erie.	Clearing lands between Crescent and Rexford Flats.	John Henkes.	10/26/12	0 10
14-B	Erie.	Completion of dams at Crescent and Vischer Ferry; removal Crescent aqueduct.	Brown & Lowe Co.	10/29/14	88,169
14-R	Erie.	Removal and reinterment of bodies in cemeteries.	Thomas F. Riley.	11/28/11	629

15	Champlain.....	Atlantic Gulf & Pacific Co.....	8/ 9/06	1,388,171
16	Erie and Champlain..	The United Construction Co.....	12/20/06	92,461
17	Erie.....	The Scofield Co.....	12/20/06	53,794
18	Erie.....	Alexander Murdoch.....	3/ 3/08	754,269
18-A	Erie.....	Kelley Bros. Contracting Co.....	12/28/06	406,585
19	Erie.....	N. Y. State Dredging Corporation.....	2/17/14	1,693,153
20-A	Erie.....	Great Lakes Construction Co.....	11/26/06	825,083
20-B	Erie.....	Houston Barnard.....	8/20/09	321,491
20-C	Erie.....	S. Pearson & Son, Inc.....	8/ 2/09	1,018,359
20-D	Erie.....	American Pipe & Construction Co.....	8/18/09	661,855
21	Erie.....	American Pipe & Construction Co.....	8/18/09	3,345,676
22	Erie.....	Lane Bros. Co.....	4/ 7/10	949,000
22-A	Erie.....	M. Fitzgerald.....	9/24/10	122,912
23	Erie.....	Lupier & Remick.....	8/ 8/12	27,870
23-B	Erie.....	Millard & Lupton Co.....	8/18/09	1,207,726
24	Champlain.....	Michael E. Sweeney.....	11/ 4/14	4,736
25	Champlain.....	Kingsbury Construction Co.....	11/ 1/11	43,841
26	Champlain.....	Atlantic Gulf & Pacific Co.....	11/19/06	1,547,193
27	Champlain.....	The Lake Erie Dredging Co.....	4/ 6/08	35,443
27-A	Champlain.....	The Kinsler Construction Co.....	11/23/06	393,535
27-B	Champlain.....	Holler & Shepard.....	12/ 1/10	548,764
29	Erie.....	John J. Farrell, Jr.....	5/23/16	6,043
30	Erie.....	Maryland Dredging & Contracting Co.....	4/ 3/09	506,502
30-A	Erie.....	Acme Engineering & Contracting Co.....	7/16/09	2,913,187
31	Erie.....	Mohawk Dredge and Dock Co. Inc.....	11/24/16	124,461
32	Champlain.....	Casey & Murray.....	9/ 2/08	753,405
33	Erie, Champlain and Oswego.....	Penn Bridge Co.....	4/19/09	44,375
34	Erie.....	Penn Bridge Co.....	1/ 7/10	170,822
35	Oswego.....	M. Fitzgerald.....	8/ 8/06	22,317
36	Erie.....	Gilmour-Horton-Allen Co.....	9/16/07	676,101
37	Oswego.....	J. D. Miller.....	5/25/10	47,210
37-R	Oswego.....	Henry P. Burgard.....	12/ 9/10	2,609,680
38	Erie.....	Saladin & Henrick.....	11/29/12	3,082
39	Oswego.....	Henry Tosh & Son.....	1/11/09	16,635
40	Erie.....	James Stewart & Co., Inc.....	4/15/10	969,803
41	Erie.....	The United Engineering & Contracting Co.....	11/27/08	2,113,231
		Butler Bros. Construction Co.....	12/ 5/08	241,741

* The date has no significance aside from the fact that the tables were compiled then.

CONSTRUCTION OF THE BARGE CANAL — (Continued)
WORK COMPLETED, EXCLUSIVE OF THAT DONE UNDER CHAPTER 585, LAWS OF 1918 — (Continued)

Contract No.	Canal	Description of work	Contractor	Date of contract	Total construction cost, including alterations and extra work orders
42	Erie.....	Lock 20 and prism, Oncida-Herkimer Co. line to Oriskany road.....	Shanley, Morrissey, Inc.....	7/ 9/09	\$478,670
42-A	Erie.....	Oriskany road to Mud creek.....	Grant Smith & Co. & Locher.....	2/24/13	1,197,578
43	Erie.....	Mud creek to east end of Contract 4.....	The M. A. Talbott Co.....	10/15/09	1,305,549
44	Erie.....	Lock 24 and prism at Baldwinsville; dam at Caughdenoy.....	Scott Bros.....	1/ 8/10	1,620,999
45	Erie.....	Lock 25 and prism, Fox Ridge to Seneca-Wayne Co. line.....	Scott Bros.....	5/ 6/08	419,510
46	Erie.....	Completion of Contract 46 from Fox Ridge to Montezuma aqueduct.....	The Kinner Construction Co.....	11/23/08	842,689
46-A	Erie.....	Completion of Lock 25.....	James Stewart & Co., Inc.....	9/ 2/14	181,338
46-B	Erie.....	Lock 26 and prism, Seneca-Wayne Co. line to Lyons.....	Scott Bros.....	2/25/16	270,974
47	Erie.....	Completion of Contract 47.....	The Crowell-Sherman-Stalter Co.....	11/30/08	833,443
47-A	Erie.....	Lock 27 and 28-A and prism, Lyons to Newark.....	Central Dredging Co.....	3/22/16	193,720
48	Erie.....	Lock 30 and prism, Yellow Mills bridge to Wayne-Monroe Co. line.....	The Sherman-Stalter Co.....	12/29/10	1,483,999
49	Erie.....	Dam and reservoir at Hinckley on West Canada creek.....	American Pipe & Construction Co.....	2/21/10	797,544
50	Erie.....	Nine-Mile creek diverting dam and feeder.....	The Buffalo Dredging Co.....	9/23/10	995,673
51	Erie.....	Lock 1 and prism, Phoenix.....	The Alto Construction Co.....	12/23/10	375,081
52	Oswego.....	Lock 7 at Fort Edward.....	Scott Bros.....	8/16/09	165,680
53	Champlain.....	Dam and reservoir at Delta on Mohawk river.....	The Hunken-Conkey Construction Co.....	12/13/09	223,893
54	Erie.....	Removal and reinterment of bodies in cemeteries.....	Arthur McMullen.....	10/19/08	884,811
55	Erie.....	Improving the Glens Falls feeder.....	Joseph Kalk & Alfred S. Brown.....	11/ 3/11	7,627
55-R	Champlain.....	Dredging through Onondaga outlet.....	Flood & Van Wirt Co.....	9/26/12	333,542
57	Erie.....	Sewers, Genesee Valley park to Court St., Rochester.....	N. Y. Murray.....	8/ 6/12	93,315
58	Erie.....	South Genesee to Adams Basin.....	P. H. Murray.....	7/ 3/16	110,031
59-A	Erie.....	Adams Basin to Monroe-Orleans Co. line.....	Empire Engineering Corporation.....	8/ 6/08	1,346,261
60	Erie.....	Monroe-Orleans Co. line to Eagle Harbor.....	Cleveland & Sons Co.....	10/13/08	1,048,666
61	Erie.....	Wayne-Monroe Co. line to Kings Bend.....	I. M. Ludington's Sons, Inc.....	8/11/10	2,854,348
62	Erie.....	Medina to Gasport.....	H. S. Kerbaugh, Inc.....	6/ 3/10	2,993,209
63	Erie.....	Prism and structures at Medina.....	Empire Engineering Corporation.....	8/ 6/08	1,199,980
64	Erie.....	Gasport to Lockport.....	Maryland Dredging & Contracting Co.....	3/26/13	1,110,918
65	Erie.....	Locks 34 and 35 and prism at Lockport.....	Empire Engineering Corporation.....	9/22/08	783,160
67	Erie.....		Larkin & Saugster.....	9/ 3/10	1,048,772

68	Champlain	Locks 3, 4 and 5 and adjoining prism	Shanley-Morrissey, Inc.	11/23/08	947,813
69	Champlain	Lock 2 and adjoining structures	I. A. Dodge & Co., Inc.	12/11/09	231,504
70	Champlain	Dredging, Waterford to Lock 1	Shanley-Morrissey, Inc.	1/11/10	236,240
70-A	Champlain	Completion of Contract 70	Central Dredging Co.	10/22/12	798,843
71	Champlain	Lock 1 and dam and dredging, Lock 1 to Lock 2	Shanley-Morrissey, Inc.	1/11/10	826,305
71-A	Champlain	Completion of Contract 71	P. McGovern & Co.	1/16/13	1,487,701
72	Champlain	Dredging, Lock 2 to Lock 4	Shanley-Morrissey, Inc.	12/14/09	618,900
72-A	Champlain	Completion of Contract 72	James Stewart & Co., Inc.	3/27/13	1,515,095
72-B	Champlain	Widening prism at mouth of Hoosic river	James Stewart & Co., Inc.	7/1/10	92,517
73	Champlain	Dredging, Lock 4 to Northumberland	E. M. Graves	5/26/10	517,223
74	Erie	Dredging Mohawk and Hudson rivers below Lock 2	Dunbar & Sullivan Dredging Co.	2/13/14	215,741
75	Erie	Guard-gates within limits of Contracts 60, 61 and 64	United Construction Co.	3/1/10	43,843
76	Erie	Lock 28-B and prism, Newark to Port Gibson	The T. A. Gillespie Co.	12/23/10	1,401,110
77	Erie	Lock 29 and prism, Port Gibson to Yellow Mills	The T. A. Gillespie Co.	12/23/10	1,691,466
78	Oswego	Dike at Fulton	Cunningham-Woodard Co.	4/18/10	50,119
79	Oswego	Superstructure for highway bridge, Bridge St., Oswego	Lupter & Remick	9/23/10	34,661
80	Oswego	Dam of Phoenix	Walter Bradley	1/16/11	112,034
81	Erie	Superstructures of highway bridges on Contract 21	Chesley, Earl & Heimbach, Inc.	10/17/10	50,594
82	Erie	Construction, Contract 19 to Niagara river, Tonawanda	Groton Bridge Co.	12/7/10	28,768
83	Erie	Superstructure, lift-bridge, Bridge street, Phoenix	Mohawk Dredge & Dock Co.	10/22/17	164,191
85	Oswego	Bridge at Canajoharie	Lupter & Remick	8/5/11	12,339
86	Erie	Lansing's bridge, Sta. 4078, Contract 20-A	Lathrop, Shea & Henwood Co.	9/23/11	39,164
87	Erie	Reconstructing portion of bridge at Schuylerville	The P. B. McCaghey Co.	2/17/13	11,400
88	Champlain	Bridges between Lyons and Palmyra, Contracts 48, 76 and 77	Lathrop, Shea & Henwood Co.	11/4/11	30,844
89	Erie	Power equipment, etc., Locks 24, Erie; 1, 2, 7, 8, Oswego, and 9, 11, 12, Champlain	Oswego Bridge Co.	5/28/12	56,205
90	Erie, Champlain and Oswego	Power-plants, etc., a Locks 1, 2, 7 and 8, Oswego canal	D'Olier Engineering Co.	4/12/10	178,733
90-A	Oswego	Power-plant, east end of Crescent dam	Lupter & Remick	8/6/12	63,137
91	Erie	New governor equipment, Crescent power-house	The Holington Co.	1/5/11	43,759
91-A	Erie	Power equipment, Locks 2 to 19, incl., guard-gate above 6, Erie; 1 to 8, Champlain	Lord Construction Co.	11/24/10	6,226
92	Erie and Champlain	Power equipment, Locks 20, 21, 22, 23 and 25, N. London junction lock, Erie; 3, 5 and 6, Oswego	MacArthur Bros. Co. & Lord Electric Co.	2/17/13	1,209,304
93	Erie and Oswego	Power equipment, Locks 26, 27, 28-A, 28-B, 29, 30, 32, 33, 34, 35 and guard-locks, Erie	MacArthur Bros. Co. & Lord Electric Co.	8/12/13	364,305
94	Erie	Bridges at Long Branch, Belgium and Hinmansville, Contracts 12, 39 and 57	MacArthur Bros. Co. & Lord Electric Co.	2/17/13	439,789
100	Erie and Oswego	Highway superstructure at Three Rivers	W. J. Burns Co.	9/12/13	162,757
101	Erie	Bridge superstructure at Howland's island	Barrally & Ingersoll	8/6/12	46,085
102	Erie	Concrete and bascule bridge at Lock St., Phoenix	Lupter & Remick	2/20/13	44,366
103	Oswego	Reinforced concrete arch bridge at Broadway, Fulton	Barrally & Ingersoll	12/10/12	183,823
104	Oswego		R. B. Murdock	3/5/12	36,886

CONSTRUCTION OF THE BARGE CANAL — (Continued)
WORK COMPLETED, EXCLUSIVE OF THAT DONE UNDER CHAPTER 585, LAWS OF 1918 — (Continued)

Contract No.	Canal	Description of work	Contractor	Date of contract	Total construction cost, including alterations and extra work orders
105	Erie.....	Lift-bridges at Spencerport, Adams Basin, Brockport, Hubertson and Gasport.....	Skene & Richmond.....	4/19/12	\$345,688
106	Erie.....	Lift-bridges Brockport, Medina, Middleport and Lockport; and guard-gate at Gasport.....	The W. S. Cooper Co.....	5/13/14	274,268
107	Erie.....	Lift-bridge and fixed bridge at Little Falls.....	Jackson L. Richmond.....	2/19/13	113,093
108	Erie.....	Highway bridges near Macedon and superstructures at Peek's and Allerton's.....	I. M. Ludington's Sons, Inc.....	10/17/13	84,199
109	Erie.....	Highway bridge at site of Crescent aqueduct.....	Larkin & Sangster.....	7/31/13	131,371
110	Erie.....	Highway bridges at James and Lawrence Sts., Rome.....	Chealey, Earl & Heimbach, Inc.....	12/ 3/13	124,239
111	Erie.....	Steel sheet-piling and slope protection within Contracts 60 and 66.....	John Young.....	4/24/13	120,319
112	Erie.....	Timber for trough at Bushnell's Basin and Holley Guard-gate above Lock 6, Waterford.....	Wm. J. Dowdle.....	4/15/13	21,571
113	Erie.....	Superstructure of Movable dam 4, Scotia.....	Chas. A. Hager.....	10/ 7/13	26,808
114	Erie.....	Bridges at toll road and County line, Contract 46.....	Penn Bridge Co.....	10/28/14	77,342
115	Erie.....	Bascule bridge over Lock 2, Fulton.....	Walsh Construction Co.....	1/16/14	77,342
116	Ontario.....	Bridge over Mohawk river at Amsterdam.....	Walter S. Rae.....	4/15/18	32,809
117	Erie.....	Driving steel sheet-piling cut-off and extending apron, Dam 5, Rotterdam.....	Lathrop, Shea & Henwood Co.....	7/29/14	134,611
118	Erie.....	Changes in Movable dams 5 to 11, inclusive, Mohawk river.....	Holler & Shepard.....	8/ 4/14	50,567
119	Erie.....	Superstructure of bridge at Sta. 2001 + 83, Contract 12.....	Whitehead & Kales Iron Works.....	7/20/14	283,026
120	Erie.....	Highway bridge over Mohawk below Little Falls, Sta. 4246 + 42.....	General Erecting Co.....	7/ 8/14	9,110
121	Erie.....	Dam and sluice gate across West Canada creek at Trenton Falls.....	Thomas Leonard.....	2/23/16	6,090
122	Erie.....	Viaduct over railroad at Vischer Ferry.....	Frank L. Cohen.....	5/11/14	17,530
123	Erie.....	Raising existing bridge at Mechanicville.....	Keith O. Guthrie.....	8/31/14	39,178
124	Champlain.....	Highway bridge at Northumberland.....	Horseheads Construction Co.....	9/ 4/14	6,101
125	Champlain.....	Freeman's bridge at Schenectady.....	Holler & Shepard.....	5/27/16	75,189
126	Erie.....	Improvement of Albany basin.....	The Foundation Co.....	6/ 6/16	82,202
127	Erie.....	Bridge at Schuylerville.....	Great Lakes Dredge & Dock Co.....	4/ 3/16	5,506
128	Champlain.....	Bridge at Schuylerville.....	Spaulding Construction Co.....	3/28/16	850

131-A	Champlain.....	Completing bridge at Schuylerville.....	M. Fitzgerald.....	3/ 5/17	37,916
132	Erie.....	Lighthouses, buoys, etc., for Oneida and Onondaga lakes.....	Lupfer & Remick.....	11/ 3/16	26,660
133	Erie.....	Excavating lock at Mohawk.....	Morrison & Quinn, Inc.....	10/ 8/16	48,433
134	Erie.....	Steel sheet-piling at Dam 19, Canajoharie.....	Great Lakes Dredge & Dock Co.....	10/13/16	48,366
135	Erie.....	Excavating channel below Lock 8, Oswego.....	J. A. Leport.....	10/13/16	17,837
136	Oswego.....	Bank protection, Hudson river north of Watford, Contract 71-A.....	Empire Engineering Co., Inc.....	11/ 3/16	4,860
137	Champlain.....	Red creek bridges, Genesee valley park, Rochester.....	Holler & Shepard.....	11/ 1/16	6,580
138	Erie.....	Completing Contract 144.....	W. F. Martins & Co., Inc.....	6/14/17	67,733
139	Erie.....	Raising existing Scotia bridge, Schenectady.....	Brown & Lowe Co. & Law Bros.....	8/27/19	5,765
140	Erie.....	New movable dam to replace Dam 14, Herkimer.....	Horseheads Construction Co., Inc.....	1/ 4/17	80,934
141	Erie.....	Bascul bridge, Main and Webster Sts., Tonawanda.....	Pechkam Construction Co., Inc.....	4/18/18	253,019
142	Erie.....	Highway bridge across Lock 27, at Leach St., Lyons.....	Lathrop, Shea & Henwood Co.....	9/10/17	67,878
143	Erie.....	Concrete apron below head gates at Vischer Ferry dam.....	Lathrop, Shea & Henwood Co.....	9/ 5/17	22,273
144	Erie.....	Repairing Lock 35, Lockport.....	Brown & Lowe Co.....	12/ 1/16	119,597
145	Erie and Oswego.....	Aids to navigation on Mohawk, Oneida, Seneca and Oswego rivers.....	Lupfer & Remick.....	11/15/19	4,389
146	Erie.....	Additional Taintor gate at Lock 27, Lyons.....	R. B. Wing & Son.....	2/28/17	8,499
147	Erie.....	Hoists for bulkhead gates, Vischer Ferry dam.....	Lupfer & Remick.....	4/ 7/17	12,258
148	Erie.....	Highway bridge across Wood creek near Sylvan Beach.....	Chealey, Earl & Hembach, Inc.....	1/31/17	9,643
149	Erie.....	Dam across old canal at Rome.....	Thos. Bowen.....	8/28/17	5,934
150	Erie and Oswego.....	Buoys and lamp posts for Mohawk, Oneida, Seneca and Oswego rivers.....	James McKinney & Son.....	4/20/17	3,127
151	Erie.....	Furnishing and delivering electric motors etc. at Rochester.....	Lord Construction Co.....	3/22/17	10,687
152	Erie.....	Drain across canal at Main St., Brockport.....	Charles A. Ingersoll.....	8/ 3/17	6,456
153	Erie.....	Completing work between Lyons and Newark, and dam at Macedon.....	Lathrop, Shea & Henwood Co.....	3/27/17	223,540
154	Erie.....	Removing Montezuma aqueduct and completing excavation.....	Mohawk Dredge & Dock Co., Inc.....	10/30/17	146,114
155	Oswego.....	Bascul bridge at Culvert St., Phoenix.....	Walker S. Rae.....	11/23/17	28,425
156	Champlain.....	Concrete guide piers near Locks 3, 5 and 6, Champlain canal.....	Bronk & Shinnery.....	10/13/17	80,352
157	Champlain.....	Temporary timber guide piers below Locks 3 and 6.....	Holler & Shepard.....	7/20/18	2,883
158	Erie.....	Junction lock and excavation at South Greece.....	Cleveland & Sons Co.....	6/28/17	60,096
159	Erie.....	Barrel buoys and lamp posts on Seneca, Clyde, Genesee and Tonawanda rivers.....	Lupfer & Remick.....	11/16/17	13,819
160	Erie.....	Lanterns for buoys, etc., on Seneca, Clyde and Genesee rivers.....	R. B. Wing & Son.....	3/15/18	8,960
161	Erie.....	Improvement of by-passes at Locks 32 and 33.....	W. P. Martens.....	2/ 9/18	47,272
162	Erie.....	Completing excavation and incidental work near Pittsford.....	L. M. Ladington's Sons, Inc.....	3/13/18	91,499
163	Erie.....	Removing Rexford Flats aqueduct.....	Dunbar & Sullivan Dredging Co.....	11/ 9/17	16,154
164	Erie.....	Waterproofing canal bottom at Little Falls.....	Law Brothers.....	3/15/18	48,233
165	Oswego.....	Completing excavation in front of dockwall below Lock 8, Oswego.....	E. Brown Baker.....	12/28/17	27,238

CONSTRUCTION OF THE BARGE CANAL — (Continued)
 WORK COMPLETED, EXCLUSIVE OF THAT DONE UNDER CHAPTER 585, LAWS OF 1918; — (Concluded)

Contract No.	Canal	Description of work	Contractor	Date of contract	Total construction cost, including alterations and extra work orders
183	Erie	Aligning bridge at W. Henrietta road, Rochester.	Donnell-Zane Co.	9/11/18	\$5,505
184	Erie	Excavation under N. Y. C. R. R. bridge at Brewerton.	Mohawk Dredge & Dock Co.	4/12/18	9,563
185	Erie	Channel improvement below dams at Scotia and Rottersdam.			
187	Erie	Bank protection between New London and Lock 22.	Am. P. & Const. Co. (R. Wetherill, Rec'r)	6/24/18	131,541
188	Erie	Completing excavation under Brewerton R. R. bridge.	Scott Bros.	8/20/18	15,585
189	Erie	Completing excavation and placing bank protection, Fairport to Kings Bend.	E. Brown Baker	8/7/18	35,996
190	Erie	Completing canal from Kings Bend to L. V. R. crossing, Rochester.	Lathrop, Shea & Henwood Co.	12/6/19	18,562
191	Erie	Completing work on Contract 59 in river south of temporary dam.	Empire Engineering Co., Inc.	3/20/19	244,307
192	Erie	Completing work on Contract 59 in Genesee Valley park and east guard-lock to Genesee river.	Empire Engineering Co., Inc.	1/14/19	155,023
194	Champlain	Completing work on Contract 1-A, Crockers Reef to Fort Edward.	Brown & Lowe Co.	1/22/19	593,286
197	Erie	Repairs to Dam 4 at Rotterdam.	Dunbar & Sullivan Dredging Co.	5/24/20	36,791
198	Erie	Highway bridge below Lock 28-A, Lyons.	Stewart Bros.	1/27/19	14,620
200	Erie	Steel sheet-piling, etc., between Rochester and Lockport.	Lupfer & Remick	8/25/19	39,341
201	Erie	Completing concrete lining at Cartersville and stream entrance near Knapp's bridge.	Lupfer & Remick	2/26/19	128,847
204	Erie	Dam across old canal, Lexington Ave., Rochester.	I. M. Ludington's Sons, Inc.	3/13/19	50,782
205	Owego	Concrete spillway below Lock 3, Fulton.	I. M. Ludington's Sons, Inc.	3/19/20	3,168
206	Erie	Raising bridge over Lock 33, Rochester.	Scott Bros.	3/30/21	40,465
207	Erie	Removing material from prism, Orr's bridge, east of Holley.	Groot Engineering Co., Inc.	8,31/21	3,667
			Byron, Forman & Riggs, Inc.	1/4/22	5,022
		Total			\$86,921,972

WORK COMPLETED ON THE ERIE, CHAMPLAIN AND OSWEGO CANALS UNDER CHAPTER 585, LAWS OF 1918*

Con- tract No.	Canal	Description of work	Contractor	Date of contract	Total con- struction cost, includ- ing altera- tions and extra work orders
1-A	Champlain.....	Completing portion of Contract 1, Crockers Reef to Port Edward.....	Holler & Shepard.....	8/ 3/14	\$312,255
19-A	Erie.....	Redredging Contract 19.....	Empire Engineering Co., Inc.....	11/ 3/16	240,523
21-A	Erie.....	Completion of Contract 21.....	Walsh Engineering Co.....	2/16/16	631,401
23-A	Erie.....	Completion of Contract 23.....	Empire Engineering Co., Inc.....	5/20/16	984,058
29-A	Erie.....	Completion of Contract 29.....	Eastover Construction Co., Inc.....	3/27/16	376,443
44-A	Erie.....	Completion of work at New London.....	Scott Bros.....	10/10/16	56,242
59	Erie.....	Rochester harbor and connecting channel.....	MacArthur Bros. Co.....	11/ 3/16	1,900,868
63-A	Erie.....	Completion of Contract 63.....	State Highway Const. Co.....	2/23/16	456,595
73-A	Champlain.....	Completion of Contract 73.....	Great Lakes Dredge & Dock Co.....	1/15/16	580,096
84	Erie.....	Viaduct over the river at Clyde.....	Lupter & Remick.....	3/ 9/17	92,421
98	Erie.....	Lift-bridge at Adams St. and removing bridge at Chapel St., Lockport.....	Triff Construction Co., Inc.....	11/24/16	84,723
99	Oswego.....	Bascule bridge at Minetto.....	Larkin & Sangster.....	9/12/16	153,086
122-A	Erie.....	Completing Contract 122.....	Chesley, Earl & Heimbach, Inc.....	3/ 8/17	81,717
138	Erie.....	Movable dam, etc., at Rochester.....	Combined Construction Co.....	4/19/17	716,030
141	Erie.....	New power-station at Lock 29, Palmyra.....	W. F. Maas & Son.....	3/ 8/17	27,193
159	Erie.....	Embankment between Newark and Palmyra and extend- ing Ganaragus creek spillway.....	I. M. Ledington's Sons, Inc.....	3/27/17	40,046
		Total.....			\$6,634,097

* This was the act which recompensed contractors for losses sustained by reason of doing work under war conditions on contracts entered into before war was declared.

CONSTRUCTION OF THE BARGE CANAL — (Concluded)
WORK UNDER CONTRACT BUT UNCOMPLETED OCTOBER 18, 1922

Contract No.	Canal	Description of work	Contractor	Date of contract	Engineer's preliminary estimate	Contractor's bid
202	Erie.....	Completing excavation and placing protection, Genesee river, Rochester.....	James Stewart & Co., Inc. Troy Public Works, Inc. Mohawk Dredge & Dock Co.	5/ 4/22 6/12/22 10/16/22 \$3,003 \$3,003	\$339,902 27,387 4,504
208	Erie.....	Tainter gate at Baldwinsville dam.....				
209	Erie.....	Raising Maguire's bridge approach within limits of Contract 62.....				
210	Erie.....	Spillway at south end, movable dam, Herkimer.....				
		Total.....				\$371,793

TOTAL CONSTRUCTION COST OF THE ERIE, CHAMPLAIN AND OSWEGO BRANCHES OF THE BARGE CANAL

ITEMS	Totals
Work completed exclusive of that done under chapter 585, Laws of 1918.....	\$86,921,972
Work completed under chapter 585, Laws of 1918.....	6,634,097
Work under contract but uncompleted, October 18, 1922.....	371,793
Special work: Completing Contracts 47-A and 63-A, relocating highways and miscellaneous extra work.....	3,003
Schenectady-Scotia bridge.....	2,724,305
	500,000
Deduct bonds of the J. R. Shanley Estate Co., held by the Comptroller.....	\$97,155,170
Total.....	469,600
	\$96,685,570

WORK COMPLETED ON THE CAYUGA AND SENECA CANAL

Contract No.	Canal	Description of work	Contractor	Date of contract	Total construction cost, including alterations and extra work orders
A	Cayuga and Seneca	Lock and dam at Cayuga	Scott Bros.	12/30/10	\$352,845
A-1	Cayuga and Seneca	Dam repairs and fish ladder at Dam 1, Cayuga	The Sherman-Stalter Co.	7/24/10	24,750
B	Cayuga and Seneca	Montezuma to Cayuga lake, Cayuga lake to Seneca Falls, Waterloo to Seneca Falls	The Sherman-Stalter Co.	12/20/10	1,313,169
C	Cayuga and Seneca	Locks, dams, etc., at Seneca Falls	Larlin & Sangster	1/11/13	1,171,914
D	Cayuga and Seneca	Dredging Seneca river, Demont's bridge through Waterloo	The Sherman-Stalter Co.	2/24/14	948,530
E	Cayuga and Seneca	Lock, dam, etc., at Waterloo	Cleveland & Sons Co.	1/7/13	317,640
F	Cayuga and Seneca	Highway bridges at Lake road, Free bridge and Demont's	Stanley Construction Co.	7/20/14	127,400
G	Cayuga and Seneca	Lock gates, valves, buffer-beams, needle-beam, Tamtor and guard-gates, Locks 2, 3 and 4, Dam 2	Lupfer & Remick	11/24/14	102,296
H	Cayuga and Seneca	Excavating Cayuga inlet at Ithaca	N. Y. State Dredging Corporation	12/22/11	218,479
I	Cayuga and Seneca	Watkins to Montour Falls	The Central Dredging Co.	9/23/12	187,350
J	Cayuga and Seneca	Bridge at Fourth St., and dockwall, Watkins	Chealey, Earl & Heimbach, Inc.	11/27/14	45,122
K	Cayuga and Seneca	Highway bridges at Ovid and Bridge Sts., Seneca Falls, and Washington St., Waterloo	The Phoenix Bridge Co.	10/30/14	60,480
L	Cayuga and Seneca	Highway bridges at Gorham St., Waterloo, and Kingdom road	Scott Bros.	9/23/15	55,554
M	Cayuga and Seneca	Power-plants, equipment, etc., Locks 1, 2, 3 and 4	Lupfer & Remick	11/3/14	190,480
N	Cayuga and Seneca	Cut-off wall below walls of Lock 3, Seneca Falls	The Foundation Co.	6/3/17	107,883
O	Cayuga and Seneca	The dolphins on Cayuga and Seneca lakes	W. F. Martens	3/3/18	5,092
Q	Cayuga and Seneca	Completing unfinished work on Cayuga and Seneca canals	The Sherman-Stalter Co.	4/30/18	173,434
R	Cayuga and Seneca	Extending sewer wall, Dam 2, Seneca Falls	Kennedy & Scullen Const. Co., Inc.	1/20/19	18,743
T	Cayuga and Seneca	Repairing sewer in Benton creek, Seneca Falls	Smith-Soper	1/3/19	5,448
U	Cayuga and Seneca	Placing fill along river bank above dam, Seneca Falls	J. B. Anglim	3/5/21	4,401
W	Cayuga and Seneca	Total.			\$5,430,770

CONSTRUCTION OF BARGE CANAL TERMINALS

WORK COMPLETED UP TO OCTOBER 18, 1922,† EXCLUSIVE OF THAT DONE UNDER CHAPTER 585, LAWS OF 1918
Chapter 746, Laws of 1911, and amendatory laws

Con- tract No.	Description of work	Contractor	Date of contract	Total con- struction cost, includ- ing altera- tions and extra work orders
1	Dockwall at Ithaca.....	New York State Dredging Corporation.....	Aug. 21, 1912	\$40,535 76
2	Dockwall at Albany.....	Raymond Concrete Pile Company.....	Aug. 30, 1912	140,474 70
2-P	Paving at Albany.....	Patrick W. Mulderry.....	Nov. 12, 1915	30,545 20
3	Dockwall and grading, Little Falls.....	Patna Engineering & Contracting Co.....	Aug. 13, 1912	60,683 60
5	Dockwall and grading, Whitehall.....	E. Brown Baker.....	Sept. 1912	52,210 94
6	Dockwall and grading, Fort Edward.....	Albert M. Baker.....	Nov. 22, 1912	46,995 70
7	Approach channel and harbor, Fort Edward.....	Alfred H. Hall, Inc.....	Oct. 3, 1912	45,741 27
7-A	Dockwall and grading, Schenectady.....	New York State Dredging Corporation.....	Oct. 14, 1912	140,255 30
8	Paving at Schenectady terminal.....	American Pipe & Construction Co.....	Oct. 14, 1912	157,745 68
8-P	Dockwall and grading, Herkimer.....	James P. Kelly.....	April 15, 1918	8,452 69
9	Dockwall and grading, Fonda.....	Patna Engineering & Contracting Co.....	Oct. 2, 1912	65,192 51
10	Dockwall and grading, Ilion.....	American Pipe & Construction Co.....	Nov. 25, 1912	57,780 42
11	Dockwall and grading, Amsterdam.....	Patrick W. Mulderry & Contracting Co.....	April 12, 1918	8,954 40
12	Fence along roadway approach, Amsterdam terminal.....	Patna Engineering & Contracting Co.....	Nov. 25, 1912	54,728 79
12-P	Guard-lock and highway bridge, Schuylerville.....	American Pipe & Construction Co.....	Nov. 25, 1912	59,868 02
13	Dockwall and highway, lower terminal, Troy.....	Anchor Post Iron Works.....	Nov. 25, 1912	1,355 25
14	Dock channel, basin, dockwall and grading at Utica.....	Kenish Engineering & Construction Co.....	Dec. 29, 1914	*78,283 37
15	Drainage of terminal site at Utica.....	Walsh Construction Company.....	Jan. 16, 1914	125,337 11
15-D	Dock machinery, Utica terminal.....	Mohawk Dredging & Dock Co., Inc.....	Jan. 8, 1913	582,834 73
15-M	Dockwall and grading, Rome.....	M. S. Talbott Company.....	Aug. 13, 1917	9,276 09
16	Macadam pavement, Rome.....	E. Brown Baker.....	Oct. 31, 1917	37,069 72
16-P	Raising dockwall and laying stone block pavement, Lockport.....	John Johnson Construction Co.....	Nov. 19, 1912	86,715 32
17	Bulkhead and harbor at Gowanus bay.....	Gao W. Rogers & Co., Inc.....	June 4, 1917	4,169 50
18	Paving at Greenpoint and West 53d street.....	The Hastings Pavement Company.....	Dec. 4, 1912	48,906 89
19-P	Paving, Erie basin, Buffalo.....	Henry P. Bergard Company.....	July 15, 1914	323,204 40
21-P	Dockwall at Fort Plain.....	Leary & Morrison Co.....	April 14, 1920	23,320 09
22	Pier at Plattsburgh.....	D. L. Taylor & Co.....	May 6, 1918	13,066 00
23	Pier at Port Henry.....	New York State Dredging Corporation.....	Mar. 31, 1913	22,839 44
25			Feb. 24, 1913	129,512 46
			Aug. 27, 1913	89,638 84

26-A	Completion of terminal at Rouses Point.....	Holler-LaDu Corporation.....	Nov. 11, 1920	28,730 40
27	Dockwall at Frankfort.....	Etna Engineering & Contracting Co.....	Aug. 27, 1918	41,249 16
27-P	Paving, Frankfort terminal.....	Patrick Mulderly.....	April 12, 1918	3,938 45
28	Dockwall and breakwater at Cleveland.....	Barrall & Ingersoll.....	Feb. 15, 1915	34,533 77
28-A	Protection of breakwaters at Cleveland.....	Barrall & Ingersoll.....	Mar. 1, 1920	19,233 55
29	Proposed dockwall and breakwater at Constantia.....	Bugene Dawley.....	Nov. 27, 1914	3,400 00
30	Dockwall, hydraulic canal wall and roadway approach, Oswego, river terminal.....	Barrall & Ingersoll.....	Nov. 27, 1914	101,780 20
33-P	Lake pier at Oswego.....	Henry P. Burgard.....	Mar. 24, 1916	338,258 26
33-P	Paving at Oswego.....	Empire Engineering Co., Inc.....	July 9, 1914	11,359 00
34	Dockwall at Thomson.....	Guy B. Dickinson.....	May 7, 1918	16,128 06
35	Dockwall at Crescent.....	Champlain Engineering and Construction Corp.....	Aug. 20, 1914	9,146 37
35-A	Dockwall extension and freight-house at Cohoes.....	Joseph P. Casey.....	Nov. 7, 1914	40,460 30
37	Dockwall, harbor and paving at Canastota.....	Holler-LaDu Corporation.....	Nov. 28, 1910	31,504 34
38	Pier at West 53d street, New York city.....	Holler and Sheard.....	Aug. 26, 1915	262,654 44
39	Grading terminal site at Albion.....	I. J. Stander & Co., Inc.....	Oct. 27, 1917	2,712 40
40	Dockwall, harbor and approach, St. Johnsville.....	Fred H. Rhodoy.....	Mar. 20, 1917	25,542 91
41	Removing buildings and grading the terminal site at Troy, upper terminal.....	Scott Bros.....	Sept. 20, 1915	1,486 80
42	Dockwall, dredging, frame freight-house, Flushing.....	Eastern Storage Transfer & Wrecking Corp.....	Nov. 20, 1918	47,313 95
43	Dockwall, dredging, frame freight-house, Flushing.....	Leonard Paving Co., Inc.....	Nov. 13, 1918	153,780 71
44	Paving at Mott Haven, Greenpoint and Gowanus bay.....	McHard-Barton Company.....	July 25, 1919	181,456 77
44-P	Dockwall, Mott Haven.....	Geo. W. Rogers Co., Inc.....	June 8, 1917	70,720 18
45	Constructing a terminal at Halletts Cove.....	Asphalt Construction Co.....	May 13, 1919	281,591 41
46	Dockwall at Westport.....	Mohawk Dredge & Dock Co., Inc.....	Nov. 28, 1919	11,702 37
47	Dock wall and pavement, Tonawanda and North Tonawanda.....	Scott Bros.....	Aug. 31, 1915	36,901 92
49	Grading terminal at Spencerport.....	I. M. Ledington's Sons, Inc.....	Oct. 5, 1915	1,354 30
50	Dockwall and roadway approaches at Medina.....	F. J. Mum Contracting Co., Inc.....	Oct. 8, 1915	807 75
51	Paving on Pier 6, East river, New York city.....	Rhodes & Clawson.....	Nov. 12, 1916	4,862 83
52-P	Grading terminal site, Middleport.....	Pred H. Rhodoy.....	Feb. 16, 1916	11,252 00
53	Pier at Gowanus bay.....	Spillan Asphalt Paving Co.....	June 13, 1919	1,052 25
54	Repairing Pier 5, East river, New York city.....	Hammond-Tracy Construction Co., Inc.....	Mar. 27, 1917	500,410 28
55	Building tracks and pavement at Rochester terminal.....	L. J. Stander & Co., Inc.....	Sept. 4, 1917	30,794 39
56	Approach tracks to pier, lake terminal, Oswego.....	Chas. Kiehm.....	June 28, 1918	93,883 71
57	Approach tracks to pier, lake terminal, Oswego.....	C. P. Boland & Co.....	Feb. 25, 1919	19,481 57
58	Railroad and crane tracks on pier, lake terminal, Oswego.....	W. P. Martens.....	Dec. 2, 1918	5,391 41
59	Approach tracks to Pier 1, Erie basin, Buffalo.....	Walsh Construction Co.....	May 6, 1918	9,110 00
60	Railroad and crane tracks on Pier 1, Erie basin, Buffalo.....	Walsh Construction Co.....	May 6, 1918	10,787 60
61	Pavement at Utica terminal.....	Harvey W. Roberts & Co.....	May 15, 1918	10,641 45
62	Railroad and crane tracks at Schenectady.....	Robert Wetherill Receiver for American Pipe and Construction Co., Inc.....	April 19, 1918	9,490 33
63	Shore protection between Pier 2 and Lake street, Erie basin, Buffalo.....	Empire Engineering Co., Inc.....	April 24, 1918	11,022 44
64			June 20, 1918	12,409 13

* Work completed by Superintendent of Public Works.

† Date of compiling table.

‡ Paid to State.

CONSTRUCTION OF BARGE CANAL TERMINALS — (Continued)

WORK COMPLETED UP TO OCTOBER 18, 1922,† EXCLUSIVE OF THAT DONE UNDER CHAPTER 585, LAWS OF 1918 (Concluded)

Chapter 746, Laws of 1911, and amendatory laws

Contract No.	Description of work	Contractor	Date of contract	Total construction cost, including alterations and extra work orders
67	Approach tracks to Pier 2, Erie basin, Buffalo.	Walsh Construction Co.	July 3, 1918	\$6,089 60
68	Shoring up Pier 4, Erie basin, Buffalo.	Walsh Construction Co.	July 3, 1918	6,270 30
69	Shoring protection between Lake street and Slip No. 1, Erie basin, Buffalo.	Richard C. Bush	Feb. 27, 1919	8,475 53
70	Raising building, Rochester.	Chas. W. Chambers	April 9, 1919	* 3,400 00
71	Completion ofeduct approach to Rochester terminal.	I. M. Livingston's Sons, Inc.	April 24, 1920	365,178 38
76	Yard tracks, Erie basin, Buffalo.	Mohawk Drudge & Dock Co.	Sept. 21, 1920	22,055 70
77	Dredging, Piers 5 and 6, Greenpoint, Long Island City.	New Jersey Shipbuilding & Dredging Co.	May 13, 1919	44,196 50
79	Buildings, wall and foundations for grain elevator, Henry street slip, Gowanus bay.	Raymond Concrete Pile Co.	Oct. 21, 1920	377,699 68
80	Concrete foundation piers of grain elevator, Oswego.	Brown & Lowe and Law Brothers.	Nov. 9, 1920	259,578 64
101	Stiff leg derricks at Albany, Whitehall, Little Falls, Rome, Lockport and Tonawanda.	Mohawk Drudge & Dock Co., Inc.	Dec. 18, 1916	39,577 95
102	Sanitary Pier 6, East river.	Edward F. Terry Mfg. Co.	Jan. 21, 1919	41,406 75
103-A	Package freight conveyors at Schenectady and Pier 5, New York.	Brown Portable Conveying Machinery Co.	Oct. 3, 1917	10,192 60
104	Electrical equipment, Greenpoint.	T. Frederick Jackson, Inc.	June 18, 1922	22,611 78
105	Electric wiring, scales, etc., at Pier 6.	Lord Electric Co.	June 28, 1918	19,395 96
106	Tractor cranes at Erie basin, Buffalo, Tonawanda, Lockport (lower) Long Island City.	The John F. Byers Machine Co.	Feb. 14, 1918	77,210 00
107	Electrical equipment, Erie basin, Buffalo.	I. Livingston & Co.	Mar. 4, 1919	28,685 91
108	Electrical equipment, Long Island City.	T. Frederick Jackson, Inc.	Nov. 21, 1919	4,644 10
109	Capstans and trolley hoists, Pier 6, East river, W. 53d St. and Utica terminal lock.	General Electric Co.	Aug. 2, 1918	18,755 00
110	Traveling wharf cranes, Pier 6, New York city, two Shaw 4-motor.	Manning, Maxwell & Moore (Purchased by Supt. of Public Works)	July 23, 1919	23,885 00
112	Trailers and hand trucks, Pier 6, Greenpoint, Mott Haven.	Leasing Company.	June 9, 1919	9,250 00
113	Capstans and trolley hoists, Greenpoint, Schenectady and Erie basin, Buffalo.	General Electric Company.	Oct. 27, 1920	14,090 00
114	Cranes, Erie basin, Buffalo.	Heyl & Patterson, Inc.	June 20, 1922	39,714 00
114-A	Furnishing and installing extension to boom of one of cranes at Erie basin, Buffalo.	Heyl & Patterson, Inc.	May 20, 1922	1,300 00
117	Motor generators and switchboards, Mott Haven and Greenpoint.	Leonard Morey.	June 20, 1919	5,202 52
124	5-ton full portal revolving jib crane at Troy.	Walter H. Wilma.	May 10, 1922	9,998 00

125	5-ton full portal revolving jib crane at Oswego.	Walter H. Wilms.	May 10, 1922	9,998 00
126	Clam-shell buckets, New York city.	Contractors Trading Co., Inc.	May 23, 1922	2,770 00
127	Lifting magnet equipment, Troy and Mott Haven.	K. I. Clisby	June 1, 1922	4,190 00
203	Frame freight-houses at Troy, Mechanicville, Fort Edward and Port Henry	Collins Brothers	Dec. 29, 1916	8,485 68
203-P	Plumbing in freight-houses, Troy.	M. J. Flannery & Son	Dec. 20, 1919	673 00
204	Frame freight-houses at Schenectady, Amsterdam, Fonda, Ilion and Frankfort.	Kennedy & Scullen	Mar. 12, 1917	19,485 82
205	Frame freight-houses at Utica and Rome	Wm. R. Kinney	Mar. 14, 1917	13,065 43
206	Frame freight-houses at Spencerport and Holley.	J. B. McCabe & Son	Jan. 29, 1917	1,397 30
207	Freight-house on Pier 6.	L. J. Stander & Co., Inc.	Jan. 11, 1918	128,500 22
207-H	Heating system, freight-house on Pier 6.	Miller & Brady, Inc.	Mar. 22, 1918	2,664 20
208	Plumbing and water-supply systems, freight-house, Pier 6.	Jarcho Bros., Inc.	Apr. 16, 1918	7,334 85
209	Frame freight-houses at Tonawanda and North Tonawanda.	Kennedy & Scullen Construction Co.	May 7, 1917	9,398 30
210	Frame freight-houses at Lockport (upper and lower sites)	G. J. & P. L. Metzger	June 4, 1917	7,542 04
211	Frame freight-houses at Newark, Albion and Medina.	Savage Construction Company	June 1, 1917	8,844 48
212	Permanent freight-house on Pier 1 Erie basin, Buffalo.	W. F. Martens & Co., Inc.	June 14, 1917	8,844 48
212-H	Heating system, freight-house, Erie basin, Buffalo.	Felton Construction Corporation	Nov. 14, 1918	190,847 74
212-P	Plumbing, freight-house Pier 1, Erie basin, Buffalo.	Power Efficiency Corporation	Dec. 6, 1919	3,540 00
213	Frame freight-house and timber derricks at Syracuse.	James J. Bresnahan	Dec. 6, 1919	3,522 00
214	Frame freight-house and paving at Amsterdam.	Savage Construction Co.	Feb. 14, 1918	20,718 22
215	Frame freight-house on Pier 2, Erie basin, Buffalo.	Kennedy and Scullen Construction Co.	Apr. 20, 1918	15,044 02
216	Freight-house and crane track, Long Island City, N. Jane St.	Savage Construction Co.	July 9, 1918	12,965 00
217	Plumbing system, freight-house, Long Island City, N. Jane St.	A. E. Norton, Inc.	Oct. 23, 1918	84,535 27
217-P	Freight-house at West 53d street, New York city.	Altman Plumbing Co.	May 29, 1919	4,315 82
218	Freight-house at Gowanus bay	Donnell-Zane Co., Inc.	May 13, 1919	43,592 80
219	Heating system, freight-house, Gowanus bay	Snare & Triest Co.	Apr. 30, 1920	660,879 80
219-P	Plumbing system, freight-house, Gowanus bay	George Gibson & Co., Inc.	June 1, 1921	4,569 80
219-W	Water-supply system, freight-house, Gowanus bay	Wm. Young Plumbing Co.	June 1, 1921	5,068 00
220	Frame freight-house extension at Utica.	Thomas E. O'Brien, Inc.	Nov. 26, 1921	5,061 00
221	Frame freight-house extension at Little Falls and frame freight-house at Herkimer.	James T. Young	Aug. 12, 1918	5,324 40
222	Frame freight-house and depressed roadway at Canajoharie.	Kennedy & Scullen Construction Co.	Aug. 30, 1918	6,293 21
223	Freight-house at Greenpoint.	J. A. Laporte	Aug. 23, 1918	4,205 40
223-P	Plumbing system, freight-house, Greenpoint.	Post & McCord	Mar. 20, 1919	78,467 32
224	Freight-house at Mott Haven.	Thomas E. B'Brien, Inc.	Sept. 10, 1919	10,393 00
225	Head-house, West 53d St. New York city.	Post & McCord, Inc.	July 29, 1920	147,345 31
225-H	Heating, West 53d street head-house.	Fox, Reynolds Co., Inc.	Dec. 5, 1919	58,128 63
226	Frame freight-house, Oswego, river terminal.	Austin Engineering Co.	Nov. 12, 1920	5,110 00
227	Frame freight-house at Gowanus bay	J. A. Laporte	Apr. 28, 1919	5,030 58
228	Frame freight-house, Rochester.	J. A. Laporte	Dec. 27, 1919	9,308 30
228-A	Extension to frame freight-house, Rochester.	W. F. Martens	Dec. 27, 1919	13,700 49
229	Foundation for permanent freight-house, Rochester.	Henry B. Reed	Apr. 5, 1921	9,531 85
232	Freight-house at Brockport.	New England Foundation Co., Inc.	Nov. 11, 1920	30,651 40
		F. W. & J. J. Crouch	Jan. 14, 1922	2,065 50
Total.				\$8,137,186 14

* Paid to State. † Date of compiling table

CONSTRUCTION OF BARGE CANAL TERMINALS — (Continued)
 WORK COMPLETED UNDER CHAPTER 585, LAWS OF 1918 *
 Chapter 746, Laws of 1911, and amendatory laws

Contract No.	Description of work	Contractor	Date of contract	Total construction cost, including alterations and extra work orders
19	Bulkhead and pier at Greenpoint.....	McHarg-Barton Company.....	Nov. 24, 1916	\$289,663 95
20	Channel, harbor, piers, bulkheads and highway bridge at Syracuse.....	Walsh Construction Company.....	Nov. 4, 1915	645,883 55
21	Piers and harbor, Erie basin, Buffalo.....	Empire Engineering Co., Inc.....	Jan. 12, 1914	\$ 928,398 37
26	Pier at Rouses Point.....	John E. Byron & Co.....	Oct. 30, 1916	23,456 67
31	Dockwall and frame freight-house at Lyons.....	Lupter & Remick.....	Sept. 30, 1916	56,544 98
36	Dockwall at Cohoes.....	Troy Public Works Company.....	Mar. 27, 1917	30,611 23
48	Dockwall at Rochester.....	Michael H. Ripton.....	Oct. 19, 1916	94,766 44
52	Repairing and extending Pier 6, East river, New York city.....	Kaufman and Garcey.....	July 27, 1916	135,004 70
53	Dockwall and bascule bridge at Ohio basin, Buffalo.....	Walsh Construction Company.....	Oct. 27, 1916	466,420 19
201	Permanent freight-houses at Albany and Whitehall.....	J. A. Laporte.....	Jan. 2, 1917	84,270 66
	Total.....			\$3,154,857 18

* This was the act which recompensed contractors for losses sustained by reason of doing work under war conditions on contracts entered into before war was declared.

WORK UNDER CONTRACT BUT UNCOMPLETED OCTOBER 18, 1922
Chapter 746, Laws of 1911, and supplementary laws

Contract No.	Character of work	Contractor	Date of contract	Contract price as modified by alterations
53-A	Completing certain portions of dockwall, Ohio basin, Buffalo.....	Great Lakes Dredge & Dock Co.....	Dec. 27, 1920	\$435,000 00
54	Grain elevator at Gowanus bay.....	Reides Construction Co., Ltd.....	May 3, 1921	1,307,420 04
55	Clarissa street approach, Rochester.....	I. M. Lorington's Sons, Inc.....	Sept. 16, 1921	6,350 00
56	Fences at Gowanus bay, Greenpoint and West 53d St., New York city.....	Leon Gottlieb Iron Works.....	Mar. 16, 1922	8,782 50
57	Fence at Little Falls terminal.....	American Fence Construction Co., Inc.....	Mar. 14, 1922	4,093 25
58	Paving, railroad and crane tracks, etc., Rochester terminal.....	I. M. Lorington's Sons, Inc.....	June 24, 1922	123,640 00
59	Paving, railroad and crane tracks, electrical work, etc., Syracuse terminal.....	I. H. Gallun.....	July 26, 1922	59,640 00
60	Dredging Henry street slip, Gowanus bay.....	Taylor Dredging Co.....	Aug. 1, 1922	19,085 00
115	Power equipment, Gowanus bay.....	The Croker National Fire Prevention Engineering Company, Inc.....	Jan. 7, 1922	57,350 99
116	Semiportal cranes, W. 53d St. and Greenpoint, New York city.....	Shepard Electric Crane & Hoist Co.....	Jan. 10, 1920	50,280 00
116 (Revised)	Semiportal cranes, Gowanus bay.....	Lambert Hoisting Engine Co.....	Oct. 11, 1921	25,500 00
118	Burtoning crane, Mott Haven.....	Lambert Hoisting Engine Co.....	Oct. 11, 1921	11,980 00
120	Cranes at Rochester.....	The McMyler Interstate Co.....	Jan. 21, 1922	16,230 00
122	5-ton traveling bridge cranes, one each at Rochester and Syracuse.....	Penn Bridge Co.....	May 9, 1922	58,300 00
128	5-ton full portal revolving jib crane, Erie basin, Buffalo.....	Walter H. Wilms.....	July 22, 1922	9,598 00
129	Lifting magnets, Schenectady; also Gowanus bay, Mott Haven, Greenpoint and Pier 6, New York city.....	K. I. Cleby.....	Aug. 29, 1922	9,500 00
130	Lifting magnets, Pier 2, Erie basin, Buffalo.....	Electric Controller & Mfg. Co.....	Aug. 26, 1922	4,512 10
131	Four 20-ton auto truck scales, Gowanus bay, Greenpoint, Mott Haven, Long Island City.....	The Fairbanks Co.....	Sept. 12, 1922	8,364 25
132	One 5-ton full portal revolving jib crane at Mott Haven.....	Walter H. Wilms.....	Sept. 25, 1922	9,598 00
132 (Revised)	One 5-ton full portal revolving jib crane, Ohio basin, Buffalo.....	Walter H. Wilms.....	Sept. 11, 1922	9,098 00
133	One 5-ton full portal revolving jib crane, Syracuse.....	Walter H. Wilms.....	Sept. 11, 1922	9,098 00
134				

CONSTRUCTION OF BARGE CANAL TERMINALS — (Concluded)
WORK UNDER CONTRACT BUT UNCOMPLETED OCTOBER 18, 1922 — (Concluded)

Contract No.	Character of work	Contractor	Date of contract	Contract price as modified by alterations
135	Generator sets, one each at Albany and Troy	K. I. Claby	Aug. 29, 1922	\$3,000 00
136	Steel tanks, 23 at Waterford	K. I. Claby	Aug. 29, 1922	3,525 00
138	Locomotive crane, Long Island City	W. H. Wilms	Sept. 20, 1922	8,000 00
230	Permanent freight-house at Rochester	W. F. Martens	July 7, 1921	182,300 25
230-H	Heating, Rochester freight-house	L. C. Greena	Dec. 20, 1921	7,205 00
230-P	Plumbing, Rochester freight-house	Arensmeier, Warnock & Zahndt, Inc.	Dec. 17, 1921	4,177 00
233	Extension of pier shed West 53d street, New York city	McHarg-Barton Co.	June 8, 1922	51,355 00
	Total			\$2,828,488 38

SUMMARY OF COST — CONSTRUCTION OF BARGE CANAL TERMINALS

ITEMS	Totals
Work completed up to October 18, 1922, exclusive of that done under chapter 585, Laws of 1918	\$8,137,186 14
Work completed under chapter 585, Laws of 1918	3,154,857 18
Work under contract but uncompleted October 18, 1922	2,828,488 38
Total	\$14,120,531 70

CHAPTER XXXIII

TABLES OF ENGINEERS

State Engineers—Deputy State Engineers—Special Deputy State Engineers—Division Engineers—Consulting Engineers—Supervising, Resident and Senior Assistant Engineers, and Expert Engineers of Corresponding Rank—Assistant Engineers.

THE names of the engineers of the grade of assistant engineer and higher ranks who have been connected with the State Engineer's department since the time of the preliminary Barge canal survey (1900) constitute the present chapter. It has been attempted to make the list complete even at the risk of including the names of some who were engaged on other work than Barge canal construction. Between 1900 and 1909 the building of State highways employed the time of a large part of the State Engineer's corps. Since the list contains all the names of the given grades in the whole department during those years, it is doubtless true that several men appear there who were engaged chiefly in highway work and whose connection with the Barge canal was rather slight or brief, or possibly who were not connected with it at all. It is not possible now without undue labor to determine just which are such names.

STATE ENGINEERS FROM 1900 TO 1922

Edward A. Bond.....	January 1, 1900, to May 1, 1904
Henry A. Van Alstyne.....	May 10, 1904, to December 31, 1906
Frederick Skene	January 1, 1907, to December 31, 1908
Frank M. Williams.....	January 1, 1909, to December 31, 1910
John A. Bensch.....	January 1, 1911, to December 31, 1914
Frank M. Williams.....	January 1, 1915, to December 31, 1921 *

DEPUTY STATE ENGINEERS

Wm. Pierson Judson.....	January 1, 1900, to December 31, 1904
Edmund F. Van Hoesen.....	January 1, 1905, to December 31, 1906
Frank L. Getman.....	January 1, 1907, to December 31, 1908
H. W. DeGraff.....	January 1, 1909, to December 31, 1910
A. G. Chapman.....	October 1, 1912, to December 31, 1914
Wm. B. Landreth.....	January 1, 1915, to December 31, 1918
R. G. Finch.....	January 1, 1919, to December 31, 1921 *

* Term unexpired.

SPECIAL DEPUTY STATE ENGINEERS

Henry C. Allen.....	May 12, 1904, to December 31, 1906
William R. Hill.....	January 1, 1907, to December 31, 1908
Wm. B. Landreth.....	January 1, 1909, to December 31, 1910
A. E. Kastl.....	January 1, 1911, to July 31, 1914
D. B. La Du.....	August 1, 1914, to July 31, 1918
Friend P. Williams.....	January 1, 1919, to May 31, 1921

DIVISION ENGINEERS

Eastern Division

T. C. Leutzé.....	January 1, 1900, to October 14, 1901
H. A. Van Alstyne.....	November 1, 1901, to May 10, 1904
Chas. W. Trumbull.....	May 20, 1904, to December 31, 1906
J. J. Creeden.....	January 1, 1907, to June 30, 1907
L. B. Harrison.....	July 1, 1907, to December 31, 1908
George D. Williams.....	January 1, 1909, to December 31, 1910
John A. O'Connor.....	February 1, 1911, to December 31, 1914
D. B. La Du.....	January 1, 1912, to August 1, 1914
R. G. Finch.....	August 1, 1914, to December 31, 1914
George D. Williams.....	January 1, 1915, to July 31, 1919
E. D. Hendricks.....	September 1, 1919, to December 31, 1921 *

Middle Division

W. H. H. Gere.....	January 1, 1900, to May 30, 1904
Charles O. McComb.....	June 1, 1904, to December 31, 1906
Henry B. Brewster.....	January 1, 1907, to December 31, 1908
Guy Moulton	January 1, 1909, to December 31, 1910
Edwin Styring	January 1, 1911, to December 31, 1914
Guy Moulton	January 1, 1915, to December 31, 1921 *

Western Division

A. J. Rockwood.....	January 1, 1900, to December 31, 1906
John P. Kelly.....	January 1, 1907, to December 31, 1908
Thomas W. Barrally.....	January 1, 1909, to December 31, 1910
Edward J. Govern.....	January 1, 1911, to March 31, 1914
Friend P. Williams.....	April 1, 1914, to December 31, 1918
L. C. Hulburd.....	January 1, 1919, to December 31, 1921 *

CONSULTING ENGINEERS

Henry C. Allen, 1916-21 *	B. H. Davis, 1919-21 *
Mortimer G. Barnes, 1907-11; 1911-15	Chauncey N. Dutton, 1900
Edward A. Bond, 1904-11	C. C. Egbert, 1909-21 *
Wm. A. Brackenridge, 1904-11	Com. Alfred Brooks Fry, 1904-11
Wm. H. Burr, 1900-1; 1911-15	Henry Goldmark, 1900; 1917-21 *
Dr. E. L. Corthell, 1904-11; 1916	E. P. Goodrich, 1917-21 *
B. F. Cresson, Jr., 1917-21 *	George S. Greene, Jr., 1900; 1911-15

* Term unexpired.

CONSULTING ENGINEERS — *Continued*

H. McL. Harding, 1917-21 *	Edward P. North, 1900
Eugene E. Haskell, 1916-21 *	Palmer C. Ricketts, 1900
D. J. Howell, 1900-1	Joseph Ripley, 1909-18
Daniel C. Kingman, 1900	Elnathan Sweet, 1900-1
Emil Kuichling, 1900; 1905	Col. T. W. Symons, 1900-1; 1904-11
Wm. B. Landreth, 1918-21 *	T. Kennard Thomson, 1911-15
T. C. Leutzé, 1900-1	H. R. Wait, 1920-21 *
E. C. Moore, 1916-21 *	Maurice W. Williams, 1918-21 *
George S. Morrison, 1900-1	George Y. Wisner, 1900
Alfred Noble, 1901	

SUPERVISING, RESIDENT AND SENIOR ASSISTANT ENGINEERS, AND
EXPERT ENGINEERS OF CORRESPONDING RANK

H. D. Alexander	B. E. Failing
Henry C. Allen	Perry Filkin
Edward Anderberg	R. G. Finch
George C. Andrews	C. H. Flanigan
T. W. Barrally	G. Edward Gibson
John R. Baxter	Carleton Greene
S. W. Belding	R. S. Greenman
O. F. Bellows	
A. S. Berguist	George H. Haley
E. J. Berry	E. D. Hendricks
J. H. Brace	J. V. Hogan
G. M. Braune	Robert E. Horton
A. E. Broenniman	C. H. Hoyt
L. D. Brownell	J. T. N. Hoyt
G. M. Bull	L. C. Hulburd
James Burden	L. S. Hulburd
Louis A. Burns	
	Charles A. Ingersoll
S. J. Chapleau	
George F. Chism	John R. Kaley
A. A. Conger	James E. Kelley
A. W. Conner	George T. Kieth
Wm. H. Cushman	H. J. Knoppel
D. H. Daley	D. B. La Du
P. H. Dater	E. A. Lamb
F. C. Davis	William B. Landreth
Wm. Russell Davis	Emile Low
H. W. DeGraff	
O. J. Dempster	C. H. MacCulloch
Daniel B. Donovan	R. J. Marcher

* Term unexpired.

**SUPERVISING, RESIDENT AND SENIOR ASSISTANT ENGINEERS, AND
EXPERT ENGINEERS OF CORRESPONDING RANK — *Continued***

Charles J. McDonough	H. E. Smith
H. D. Miller	N. Spencer
George C. Mills	A. E. Steere
Harry J. Morrison	G. F. Stickney
T. J. Morrison	G. W. Stickney
A. R. Morse	Edwin Styring
Guy Moulton	
	Earle Talbot
C. R. Neher	
	G. G. Underhill
G. I. Oakley	
J. A. O'Connor	Henry A. Van Alstyne
James J. Overn	E. F. Van Hoesen
	W. H. Van Wie
M. B. Palmer	
E. V. R. Payne	Fred J. Wagner
John G. Peck	D. D. Waldo
R. E. Phillips	D. A. Watt
E. J. Pickwick	W. B. Watson
C. Arthur Poole	D. C. Wedgeworth
	Harry A. Weeks
J. M. C. Quarles de Quarles	Noble E. Whitford
	M. W. Wilbur
O. C. Richards	W. G. Wildes
T. M. Ripley	H. P. Willis
Dana W. Robbins	Frank M. Williams
	Friend P. Williams
F. N. Sanders	Maurice W. Williams
Fred W. Sarr	George R. Winslow
S. M. Savage	C. H. Wood
H. O. Schermerhorn	
H. C. Smith	W. H. Yates

ASSISTANT ENGINEERS

W. R. Abbott	Charles W. Ashby
Arthur Adams	F. C. Ashley
C. H. Adams	C. G. Atkin
M. J. Adams	Henry Auerbach
J. Ray Aikenhead	A. G. Austin
H. D. Alexander	E. F. Ayres
C. R. Allen, Jr.	
Edward Anderberg	J. F. Bach
Elias H. Anderson	I. S. Badger
George C. Andrews	T. S. Bailey
A. F. Armstrong	George F. Baker
Hubert T. Arnold	H. W. Baker
P. L. Arnold	C. L. Baldwin

ASSISTANT ENGINEERS — *Continued*

C. L. Bannister	Joseph P. Burns
Philip C. Baron	Louis A. Burns
T. W. Barrally	J. Otis Burt
R. N. Barrett	John L. Bush
L. Bartlett	
Charles Bauminister	R. W. Cady
L. G. Bayly	W. L. Caler
E. J. Becker	R. D. Cameron
S. W. Belding	Albert G. Card
H. Bell	S. F. Carlisle
J. C. Bell	William H. Carnrike
D. E. Bellows	H. A. J. Castor
O. F. Bellows	S. J. Chapleau
S. R. Bellows	A. G. Chapman
H. W. Benedict	J. L. Chapman
W. C. Benedict	C. R. Chase
Louis R. Bennett	George F. Chism
F. A. Biggi	C. M. Chuckrow
Harold Bills	John S. Clancy
J. S. Bixby	A. T. Clark
L. B. Blade	Dorlon Clark
F. E. Blake	E. C. Clark
H. E. Blake	L. R. W. Clark
R. R. Bradbury	H. L. Clarke
George W. Bradley	Pitson J. Cleaver
Joseph Brady	E. J. Clohessy
H. E. Brainard	S. Cohen
E. A. Brainerd	John D. Colby
W. C. Bratton	C. M. Cole, Jr.
H. E. Breed	Isaac O. Cole
S. E. Brettheimer	W. L. Coler
Henry B. Brewster	R. V. Collins
George H. Briggs	A. W. Conner
G. M. Briggs	David R. Cooper
Frank W. Bristow	Horace Corbin
G. C. Britton	Charles W. Costello
Clark Brown	N. E. Cottrell
H. H. Brown	W. S. Coulter
Otto Brown	F. H. Crafts
W. W. Brown	W. G. Craig
James K. Browne	Wm. P. Creager
L. D. Brownell	J. H. Crewell
F. H. Brundage	Foster B. Crocker
P. H. Budd	Wm. W. Cronin
George M. Bull	F. S. Crowell
James Burden	C. F. Crowley
O. L. Burdette	A. G. Cryslar
C. E. Burleigh	F. C. Curtin
	C. A. Curtis

ASSISTANT ENGINEERS — *Continued*

Dewitt H. Daley	P. C. Gallup
P. H. Dater	Ely Gamse
F. C. Davis	Louis Garbi, Jr.
J. C. Davis	H. A. Gehring
C. R. DeGraff	R. C. Georger
H. W. DeGraff	G. E. Gibson
C. J. Dempsey	R. G. Gibson
O. J. Dempster	W. J. Gilmour
W. H. Dernell	Hall Gleason
Wayland Dickens	F. F. Gordon
F. J. Doerhoefer	P. E. Green
E. A. Dollard	George E. Greene
James Dollard	Harry H. Greene
Daniel B. Donovan	R. S. Greenman
J. B. Doughty	M. W. Grimes
E. J. Doyle	
J. B. Doyle	P. L. Haas
R. E. Drake	E. C. Hackett
George L. Dunlop	L. L. Hadley
W. J. Durkan	George S. Haight
	H. W. Hale
F. M. Eames	George H. Haley
G. Edson	B. I. Hall
Charles M. Edwards	Bruce L. Hall
Frederick Edwards	F. B. Hall
Edward M. Ellis	George F. Hall
C. E. Elmendorf	Louis W. Hall
G. A. Ensign	G. R. Halpin
A. M. Evans	R. J. Harding
M. D. Ewell	W. G. Harger
	C. E. C. Harris
B. E. Failing	Ford W. Harris
George A. Fairbanks	Frederic W. Harris
W. F. Farley	Oscar Hasbrouck
Perry Filkin	Harvey F. Hawley
J. C. Finch	A. G. Hayden
Martin A. Finch	H. E. Hayes
R. G. Finch	R. D. Hayes
Thomas E. Finucane	C. L. Hayward
C. F. Fisher	T. R. Hazelum
C. T. Fisher	H. A. Helling
Lewis G. Fisher	H. J. Hemstreet
C. H. Flanigan	C. L. Henderson
F. H. Flint	E. D. Hendricks
J. B. Foote	L. A. Hequenborg
H. E. Freleigh	Edwin Hilborn
Daniel F. Fulton	R. B. Hoadley, Jr.

ASSISTANT ENGINEERS — *Continued*

J. V. Hogan	C. A. Lansing
F. B. Holmes	Frank P. Larmon
Glenn D. Holmes	Samuel Lavine
C. A. Holmquist	Elmer C. Lawton
Royden L. Holt	Frederick T. Lawton
R. Hopkins	Clyde E. Learned
Robert E. Horton	David R. Lee
Garret O. House	E. H. Leggett
J. M. Howard	F. Leiser, Jr.
L. T. Howard	A. A. Levison
E. J. Howe	D. J. Levinson
C. H. Hoyt	O. F. Lewis
John H. Huber	Kieffer Lindsey
W. T. Huber	T. J. Loonie
J. W. Hughes	B. J. Lowenstein
L. C. Hulburd	F. J. Lynch
L. S. Hulburd	
H. C. Humphrey	C. H. MacCulloch
R. C. Hunter	R. Mack
Grant Huntley	Francis W. Madigan
Harry C. Hutchins	J. B. Maguire
J. J. Hynes, Jr.	R. J. Marcher
	R. M. Mark
C. A. Ingersoll	Frank T. Marsh
L. W. Irish	L. H. Marsland
M. E. James	I. E. Mathews
G. H. Jones	I. S. Matlaw
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